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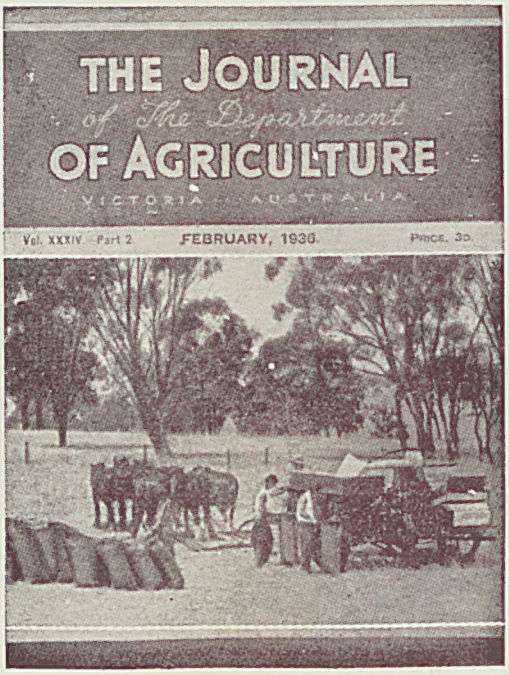

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NATIONAL MUSEUM OF VICTORIA

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Issued under the direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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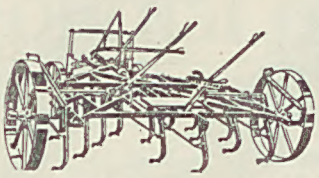

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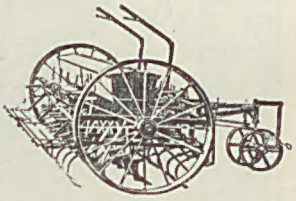

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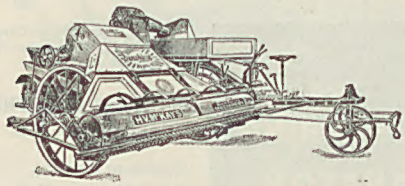

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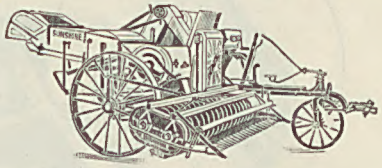

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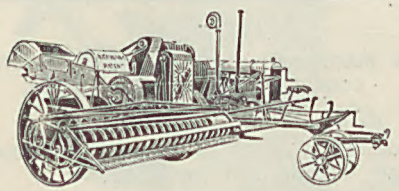

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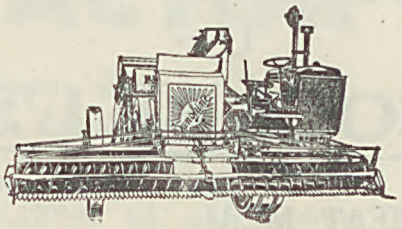

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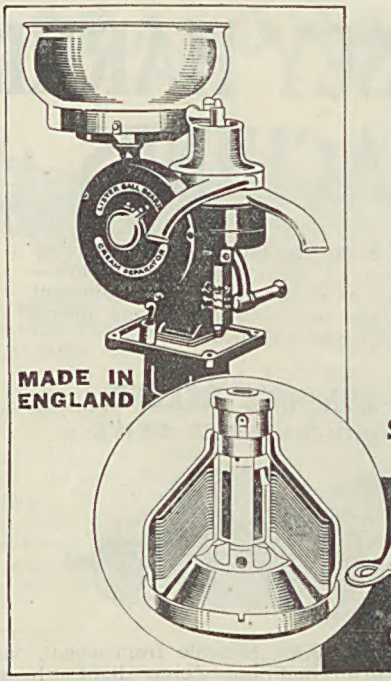

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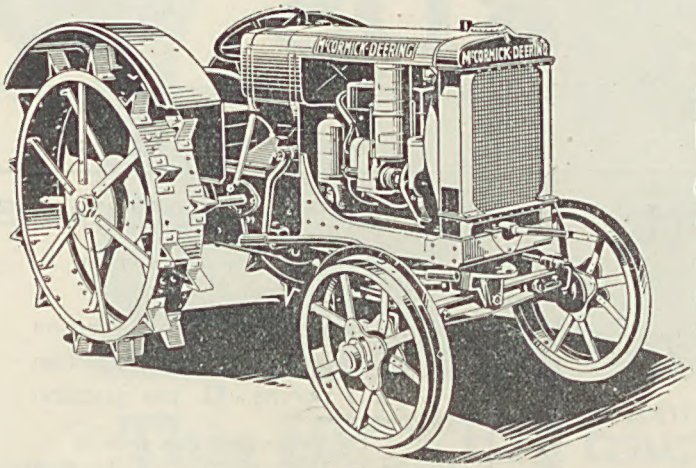

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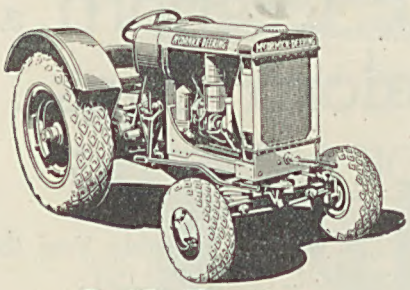

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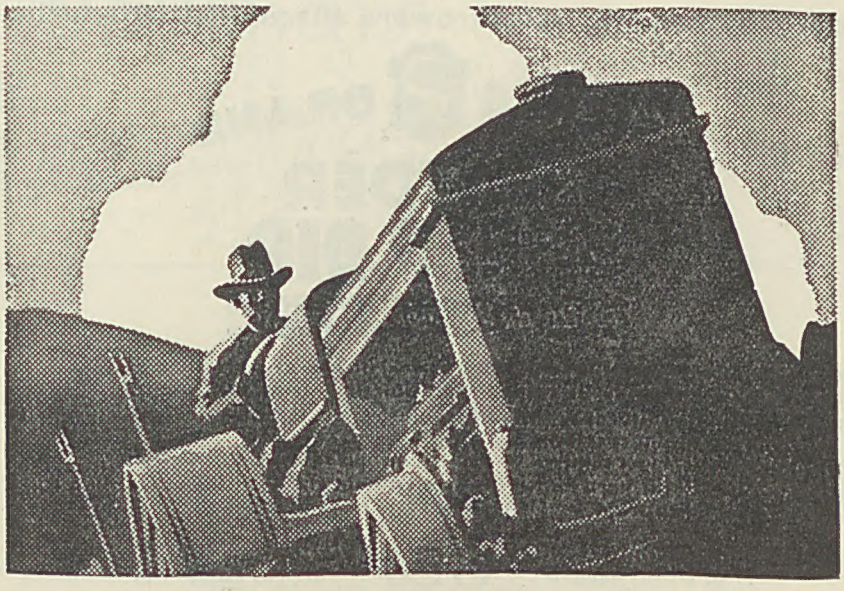

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Mallee Wheat Tests

Research Station Results

By W. B. Miller, M.Agr.Sc., Senior Inspector of Agriculture, and H. L. Hore, B.Agr.Sc., Officer in Charge, Mallee Research Station.

THE establishment of the Mallee Research Station at Walpeup in 1932 was made possible by the decision of the Government of the day to allot for that purpose portion of the Wheat Marketing Fund. This fund consisted of moneys derived from the sale of Roumanian bonds accepted in payment for wheat delivered during the war, and expenditure from the fund was limited by Act of Parliament to educational, scientific, or experimental work for the promotion of wheat production. Early in 1932 it was determined to operate the fund, and, having regard to the fact that it was derived from the whole of the wheat-growers of the State, it was considered that it should be used to develop a comprehensive scheme of wheat research designed to benefit all wheat-growers and having particular reference to the breeding of varieties of wheat more suitable to the various districts. The Government, therefore, adopted a proposal that the accumulated interest in the fund should be used for the erection and equipment of a scientific wheat research laboratory at the State Research Farm, Werribee, and the establishment of a central Mallee Research Station.

The decision to establish a research station in the Mallee was influenced by the fact that the Wimmera, the Goulburn Valley, and the North-East all had their State institutions, but the Mallee, comprising 11,000,000 acres, or one-fifth of the State, had no permanent institution for research work at which a resident staff could attack the problems.

The policy was adopted of locating the experiment station at the geographic and climatic centre of the Mallee, and of supervising the associated district plots by the staff resident at the central institution. Before adopting Walpeup, the advantages and disadvantages of twelve areas in various parts of the Mallee were reviewed. The factors in favour of Walpeup were—(*a*) its central situation; (*b*) climatic conditions there are average, avoiding the region of highest rainfall in the south and the region of lowest and most unreliable rainfall in the extreme north-west; (*c*) the soil was virgin, and comprises a range of five important types; and (*d*) portion of the area had been under experimental plots for a number of years.

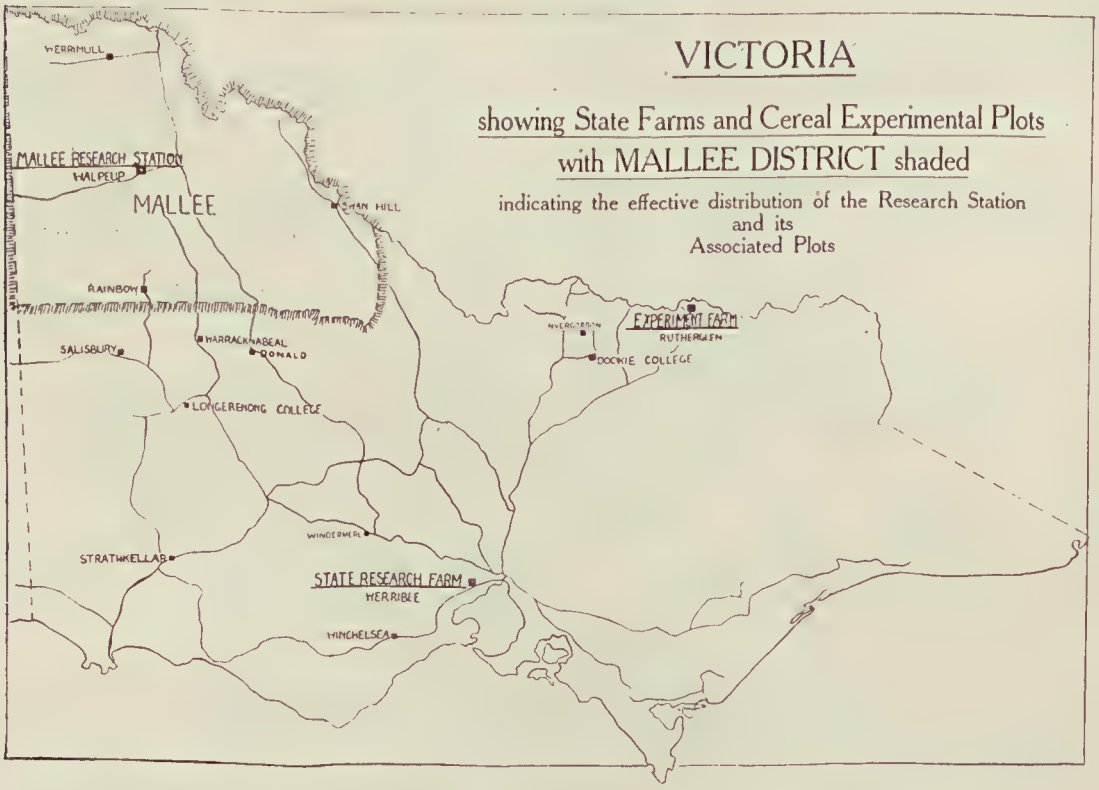
Accordingly an area of 1,928 acres of Crown land 1½ miles from the Walpeup township was selected and permanently reserved for use as an experiment station by the Department of Agriculture. It is intended that the station will serve as a centre for research and investigation into wheat-growing and allied problems in the Mallee, and that it will be supported by experimental plots in other appropriate districts throughout the Mallee, similar to those which have been conducted by the Department at Carwarp, Walpeup, Manangatang, Cowangie, Swan Hill, and Rainbow. In 1932 a comprehensive series of tests was successfully inaugurated at Werrimull, in the Millewa, to replace the plots

previously conducted at Carwarp on the property of the late P. G. Stewart, M.H.R. The Mallee, therefore, is now served by a central station at Walpeup, with district plots at Swan Hill, Werrimull, and Rainbow, where results obtained at Walpeup will be confirmed and demonstrated under local conditions. Further plots of this nature will be established as opportunity offers.

The work of development so far has consisted chiefly in preparing for cultivation the homestead block of 638 acres and the Kattyong Block of 280 acres, an area of a little over 600 acres now being available for cropping. Approximately 200 acres of land was fallowed in 1935, 83 acres of this area being sown to wheat plots, and the remainder to bulk crops. The total area used for experimental work in 1936 is 113 acres, oat plots, most of which are on stubble land, occupying 30 acres. Bulk crops consist of 140 acres of oats, and approximately 108 acres of wheat—half of the latter being on new ground. The oat varieties sown are Mulga, Dawn, and Algerian—the wheat varieties Ghurka, Ranee 4H, and Sepoy. Seed wheat of these varieties was available for distribution from this station last year, some 120 farmers being supplied. In addition to the larger area cleared, the station is now more fully equipped, and this will facilitate the extension and conduct of further activities. The resident officer in charge is Mr. H. L. Hore, B.Agr.Sc.

Seasonal Conditions.

The season to date has been satisfactory. A good soaking rain early in April germinated oats sown about that time, and fallows were then either worked over again, or sown to wheat, in which case a satisfactory germination was obtained. A period causing some anxiety was experienced from late April until the end of May, and crops which were sown within this time germinated poorly. The last two days of May and the 1st of June provided 127 points of rain, and it was found that little damage had been done to grain in the ground. June rainfall was low but sufficient for requirements. Cold weather and a late start in many cases caused growth to be backward, but with the advent of warmer weather, good headway was made and prospects are excellent, only normal finishing rains being required to ensure good yields.



Visitors inspecting the experimental plots at the Mallee Research Station.

The monthly rainfall for the present year, and averages over 24 years are as follow :—

Month.	1932.	1933.	1934.	1935.	1936.	Average 24 Years.
January ..	12	133	99	34	274	50
February ..	251	..	62	2	5	89
March ..	187	15	19	71	26	86
April ..	110	11	116	89	120	72
May ..	122	170	..	59	108	136
June ..	188	29	21	114	66	134
July ..	117	148	88	118	256	110
August ..	307	138	105	72	94	136
September	47	154	128	106	..	156
October ..	49	104	376	173	..	143
November..	1	149	175	14	..	94
December ..	118	346	31	47	..	104
April–Nov.	943	903	1,009	745	..	981
Total ..	1,509	1,397	1,220	899	..	1,309

Summary of the Tests.

Prior to 1932, the experiments at Walpeup had been confined to comparisons of wheat and oat varieties and manurial trials, sown during May. As the time of sowing has a considerable effect on the yields obtained, it is essential that the optimum time of sowing for each variety should be determined. Similarly different results may be had for varying amounts of manure when the crop is sown early or late. For this reason all the major trials have been sown at three different times. The experiments this year include—

A. *Experiments with Wheat (on fallow)*—

(1) Manurial trials, sown early, mid-season, and late.

(2) Variety trials, sown early, mid-season, and late.

(3) Rate of seeding trials, sown early, mid-season, and late.

(4) Time of seeding trials.

(5) Cultivation trials.

B. *Experiments with Oats (on wheaten stubble land)*—

(1) Variety trials—(*a*) for hay; (*b*) for grain.

(2) Manurial trials, nitrogen and super.

(3) Rate of seeding trials.

(4) Oat grazing and recovery trials.

C. *Trials of New Selections and Crossbreds*—

Stud plots and selection rows and plots of new selected and hybrid varieties of wheat, oats, and barley.

D. *Flag Smut Investigations*—

(1) Trials to determine the susceptibility of standard and new varieties to the wheat disease, flag smut.

(2) Trials to determine the effect of various manures and other factors on the infection of flag smut.

(3) Trials to determine the effect of the disease on the yield of different wheat varieties.

E. *Investigation into Possible Fodder Crops for the Mallee*—

A pasture plant nursery has been established, and preliminary tests of various species of grasses and other plants are being made.

Layout of the Experiments.

In order that varying soil conditions may not affect the comparisons between plots, it has been found advisable to replicate or repeat each plot in a trial. Each treatment or variety is sown once in a block of plots, and the whole block is then repeated at least four times. The method is termed the Randomized Block system. Not only is the average yield of the plots of each treatment more representative of the true yield of that treatment, but the method also enables one to obtain a measure of the variation between the plots. The extensive nature of the work performed this year is indicated by the following summary of the plots sown in each section :—

Wheat plots (manurial, variety, &c.)- 908 plots.
Oat plots (variety, manurial, observation, &c.)—282 plots.
Barley Observation plots—8 plots.
Stud rows—968 rows.
Flag Smut Investigations—
Drill plots—36 plots.
Hand rows—775 rows.

A plot of Ghurka, one of the leading wheat varieties.

The field in which the main section of wheat plots is located, this year, is being laid down as the Permanent Experimental Field in which various types of manurial, rotation, and cultivation methods will be tested on permanent sites. The paddock was cleared in 1932, sown to Ranee 4H wheat in 1933, oats 1934, and fallowed in 1935. Prior to clearing, opportunity was taken to carry out an exact survey of the timber and vegetation over the area. With the help of a similar chemical soil survey, it is hoped that valuable correlations between native vegetation, soil analysis, and final yield of the wheat crop will be possible. In order to test the uniformity of the soil the bulk wheat crop, in 1933, was cut into numerous blocks and harvested as a uniformity trial. This year opportunity has again been taken to test the natural variation of the soil, the sites of the permanent experiments being laid out in plots of similar size, and all being sown to wheat under the same conditions. This work involves the sowing and harvesting of some 268 plots. A broad scale timber and soil survey of the whole farm is being carried out as the development continues.

RESULTS OF EXPERIMENTS.

Wheat Manurial Trials.

This year's manurial trials with wheat were sown in three sections—(*a*) Early (24th April); (*b*) mid-season (19th May); and (*c*) late (19th June). The results of the 1933–35 trials are set out in Table I., and show clearly the marked response to superphosphate at each time of sowing.

TABLE I. WHEAT MANURIAL TRIALS, AVERAGE THREE YEARS, 1933–35.

Treatment.	Sown Early.	Sown Mid-Season.	Sown Late.	Average Three Times of Sowing.
No manure ..	18·9	20·8	16·6	18·8
Super. 30 lb. p.a.	21·6	23·3	20·9	21·9
,, 60 lb. p.a.	25·1	25·2	22·9	24·4
,, 90 lb. p.a.	26·2	26·5	23·7	25·5
,, 120 lb. p.a.	27·7	27·6	24·5	26·6
Average yields	23·9	24·7	21·7	..

The results of the manurial trials at Walpeup over the last eleven years, are set out in Graph 1. Graph 2 shows the increased returns which may be expected from the various applications of superphosphate when wheat is valued at 3s. 6d. per bushel at country sidings, and superphosphate at £4 6s. per ton on the farm.

From these results it appears that, under conditions similar to those at Walpeup, the most profitable dressing for wheat on fallow is about 90 lb. per acre.

Wheat Variety Trials.

The variety trials were sown on fallow in three sections—early (23rd April), mid-season (20th May), and late (18th June). The rate of seeding was 60 lb. per acre, with superphosphate at the rate of 90 lb. per acre.

With the results of not less than three years' experiments in variety trials available at the Mallee Research Station, opportunity was taken this year to review the results of the varieties under test. As certain varieties, namely, Early Gluyas, Waratah, Mac's White, Yandilla King, and the crossbred Major x Rance W4020 K12–1, consistently yielded below the standard set by other wheats in the test—they were eliminated. To replace the varieties which were discarded, five wheats, which had given definite promise in less comprehensive tests were included. These

A crop of Rajah at the Mallee Research Station, Walpeup.

varieties were Baldmin, Bencubbin, Dundee, and two crossbreds, namely, Major x Gallipoli W5817 J5–2–2, and Sepoy x Free Gallipoli W4081 L6–1.

The results of this section of replicated variety trials for three years are shown in Table II.

TABLE II.—WHEAT VARIETY TRIALS, AVERAGE THREE YEARS, 1933–35.

Variety.	Sown Early.	Sown Mid-Season.	Sown Late.
Sepoy	30·2	24·2	22·9
Rance x Gallipoli W5807	28·0	25·1	23·4
Rajah	28·1	24·6	22·7
Rance 4H	28·1	24·4	22·4
Imp. Gluyas x Rance ..	27·7	24·6	22·3
Nabawa	26·7	23·6	23·8
Ghurka	26·4	24·1	23·1
Free Gallipoli	25·6	25·7	22·1
Currawa	24·6	23·3	21·6
Yandilla King	25·5	23·7	18·5
Early Gluyas	24·4	22·6	22·4
Joffre	24·1	23·3	21·5
Waratah	24·5	22·5	21·8
Major x Rance	26·5	23·7	18·6
Mac's White	23·6	21·9	20·7

The average results of variety trials, which have been conducted at Walpeup for the past ten years (Table III.), show that the best returns for this district have been obtained from Sepoy, Ghurka, and Rance 4H. The latter two varieties have better grain characteristics and are recommended for general sowing in Mallee districts.

TABLE III.—WHEAT VARIETY TRIALS. AVERAGE RESULTS FOR 10 YEARS.

Variety.	Average Ten Years 1925–35.	Average Six Years 1930–35.
Sepoy	22·2	25·5
Ghurka	21·8	25·3
Rance 4H	21·5	25·3
Free Gallipoli	21·6	25·0
Currawa	21·0	24·7
Joffre	..	24·5
Nabawa	..	24·2
Rajah	20·9	24·4

In addition to the varieties tested in the above major trials, a further test with other promising new crossbreds and leading wheats from other States is sown each year. The varieties in this trial include, among others, wheats of superior milling qualities, viz.:—Ford, Baringa, Carrabin, and Dundee.

These plots were sown on 3rd June with 60 lb. of seed and 90 lb. of superphosphate.

Typical heads of Ghurka.

TABLE IV.—NEW CROSSBRED AND VARIETY TRIALS SOWN MID-SEASON.—REPLICATED.

Variety.	Yield, 1935.	Average Three Years (1933–35).
Baldmin	35·3	..
Bencubbin	34·5	27·5
Currawa x Ind. E. x Telfords's	34·2	27·8
Free Gallipoli	32·8	27·0
Ranee 4H	32·5	26·4
Bobin	31·4	25·7
Ranee x Gallipoli W5806 ..	30·6	..
Dundee	30·4	..
Mac's White x Glencope ..	29·2	25·2
Ford	29·0	..
Ranee	28·5	23·9
Kirley's Early	27·8	..

Rate of Seeding Trial.

This trial was designed to test four rates of seeding, as follow—30 lb., 45 lb., 60 lb., and 75 lb. per acre, and, as in the other major trials, the plots were sown at the three periods—early, mid-season, and late. The average results of the trial for 1933, 1934, and 1935, shown in Table V., indicate that, during those years, variations in the rates of seeding did not have any marked effects on the yields obtained.

TABLE V.—RATE OF SEEDING TRIALS, AVERAGE THREE YEARS, 1933–35.—REPLICATED.

Rate of Seeding.	Early.	Mid-season.	Late.
	bus./ac.	bus./ac.	bus./ac.
30 lb. per acre ..	25·7	23·2	22·8
45 ,, ,, ..	26·7	22·8	23·4
60 ,, ,, ..	26·4	23·5	22·8
75 ,, ,, ..	25·9	22.8	23·2
Average Yield	26·2	23·1	23·1

Time of Sowing Trials.

In the Mallee, highest yields are usually obtained by sowing early, provided that the land is reasonably free from weeds. In seasons with a dry spring, late sown crops seldom yield equal to those sown early, but, as in 1934 and 1935, late spring rains sometimes benefit late sown crops to a greater degree.

TABLE VI.—TIME OF SEEDING TRIALS, AVERAGE RESULTS, THREE YEARS, 1933–35.
Variety, Ranee 4H.

—	Average Yield Sown Early.	Average Yield Sown Mid-season.	Average Yield Sown Late.
	bus./ac.	bus./ac.	bus./ac.
Time of sowing trial ..	28·4	26·5	23·8

Cultivation Trials.

Cultivation trials were commenced at Walpeup in 1933, the following cultivation systems being tested in duplicate plots :—

(*a*) Deep fallow, ploughed 5 inches, mid July, cultivated and sheeped in standard manner.

(*b*) Normal fallow, ploughed 2½ inches, mid July, cultivated and sheeped in standard manner.

(*c*) Late fallow, ploughed 2½ inches, late September, cultivated and sheeped in standard manner.

(*d*) Sheeped fallow, ploughed 2½ inches, mid July, not cultivated till autumn.

(*e*) Neglected fallow, ploughed 2½ inches, mid July, neither cultivated nor sheeped.

(*f*) Non fallow, ploughed just before seeding.

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The problem of drift control in fallows is one of great importance. The suggestion has been made that drift could be eliminated to a considerable extent by the practice of sowing a cereal crop in September, on land which has been fallowed and treated in the normal manner up to this time. The crop, sown in September, is grazed out after the plants have been firmly established, and the roots and remaining stalks are expected to hold the soil till after the summer when the land is again worked and sown in the usual way. Plots incorporating this practice are now included in the above trials, but no results are yet available.

The results of two years' cultivation trials are given in Table VII.

TABLE VII.—WHEAT CULTIVATION TRIALS, 1934–35.

Treatment.	Yield.	
	1934.	1935.
	bus./ac.	bus./ac.
Deep fallow	19·9	23·2
Normal fallow	18·1	23·6
Late fallow	17·2	22·6
Sheeped fallow	8·8	22·5
Non-fallow	4·2	20·1
Neglected fallow	4·0	13·7

These plots are sown at the normal seeding time with Ranee 4H seed at the rate of 60 lb. per acre and superphosphate at 90 lb. per acre.

Methods of cultivation vary according to the seasonal conditions, and particularly with the weed growth.

Efficient cultivation is more important where weeds are numerous as is indicated by the results of the 1933–34 trials on land where mustard was a problem. Very low yields were obtained from the non-fallow and neglected fallow plots, while sheep were unable to replace cultivation in weed control.

The site for the 1934–35 tests was on comparatively clean country, and the effect of neglect was less marked. Late fallowing (in September) caused a reduction of one bushel to the acre compared with July fallowing in each year.

OATS.

Large areas of oats are sown each year on unfallowed land in the Mallee, hay being the principal objective, though considerable quantities of grain are harvested in good seasons. In recent years, and since more attention has been given to sheep, oats have been used extensively for grazing. The investigations at the Station comprise tests with oats for hay, grain, and feeding off purposes.

Oat Variety Trials.

An extensive series of oat variety trials was sown early in May this year on wheaten stubble land with 55 lb. of seed and 40 lb. of super. per acre. The experiment is divided into two sections, one portion being cut for hay, and the other stripped for grain.

Hay grown at the Mallee Research Station. Varieties—Mulga and Algerian.—90-ton stack.

The varieties in their order of maturity are Mulga, Belar, Early Khorson, Palestine x Dawn M5126 R4–1–1, Gidgee, Guyra, Dawn, Ideal, Palestine x Dawn M5126 R46–2–1, Lachlan, Wild Oat x Ruakura x Kanota W5001 K6–3–1, Algerian Selection O1 P4, and Algerian. Of these, the two Palestine x Dawn crossbreds, and Algerian Selection O1 P4 are included for the first time, while Palestine and Burt's Early, have been omitted.

In 1932, the trials were conducted on stubble land, and in that favorable season very good crops of hay were obtained. The early maturing types such as Mulga produced considerably higher yields than Algerian, the latest maturing variety.

The 1933 trials were conducted on fallow land, and again an early maturing variety—Guyra—gave the greatest return, while Mulga yielded more than Algerian. In 1934, the late maturing types, as Algerian, were favoured by late rains and gave the best results, while last year Dawn, Mulga, and Guyra, were the most prominent. **There is little doubt that the earlier maturing features of these varieties warrant the adoption of at least one of them on a considerable portion of the area sown to oats in the central and northern Mallee.**

The average results of the oaten hay tests for the four years, 1932 to 1935, are given in Table VIII.

TABLE VIII.—OATEN HAY VARIETY TRIALS, 1932–35.

Variety.	Yield, 1935.	Average, Four Years. 1932–35.
	cwt. per acre.	cwt. per acre.
Dawn	11·3	30·6
Lachlan	10·6	30·1
Guyra	10·0	29·6
Algerian	9·3	28·7
Mulga	11·8	28·4
Gidgee	10·2	27.9
Belar	10·4	26·5
Burt's Early	9·3	25·1
Palestine	9·5	22·4
Wild Oat x Ruakura x Kanota W5011, K 6–3–1 ..	10·8	..
Wild Oat x Ruakura x Kanota W5010, K 9.3.1 ..	9·5	..
Ideal	8·2	..

Unfortunately, the grain tests were ruined by high winds during the 1932 and 1933 seasons, and many of the plots lodged and shed badly, so making the tests unreliable, and the results were discarded.

Owing to the heavy rains received in October, 1934, the late varieties in this year naturally outyielded those maturing earlier. These latter were adversely affected by the wind and rain. Growth on the 1935 plots was poor and the yields were low.

Oats are notoriously difficult to harvest satisfactorily owing to the difficulties experienced in stripping all varieties under similar conditions, and the irregular effects of storms, the yields obtained have not truly represented the relative yielding capabilities of the varieties. It is evident, however, that the earlier maturing varieties give higher yields of grain unless good rains are received in the late spring. A large number of new crossbreds and selections is now under observation, and efforts are being made to produce varieties which will withstand storms to a greater degree than existing varieties.

Manurial Trials with Oats.

Tests have been sown to determine the effect of various applications of superphosphate and super. and ammonia fertilizer mixtures. This experiment, which was sown with Mulga oats on wheaten stubble ground, has shown that small increases of hay can be obtained by the use of super. and ammonia mixtures in this district, but so far the increases have not been sufficiently large to pay for the cost of the fertilizer. It is doubtful also whether the use of superphosphate with oats on stubble land is warranted.

TABLE IX.—OAT MANURIAL TESTS (ON STUBBLE LAND), AVERAGE TWO YEARS, 1934–35.

Treatment.	Yield.
	cwt. per acre.
No manure	8·2
Super. 30 lb. p.a.	9·4
Super. 60 lb. p.a.	9·8
Super. 30 lb. ammonium sulphate, 30 lb. p.a.	9·7
Super. 60 lb. ammonium sulphate, 30 lb. p.a.	10·9
Super. 60 lb. ammonium sulphate, 60 lb. p.a.	10·9

Rate of Seeding Trials have also been sown with both Mulga and Algerian varieties. Prior to 1935 hay yields only were obtained from these tests, but in that year, grain yields also were obtained. These results show but little difference in the yield obtained from various rates of seeding on clean land.

TABLE X.—RATE OF SEEDING TRIALS—OATS.

Hay Section, Three Years, 1933–35.

Rate of Seeding.	Algerian.	Mulga.
	cwt. per acre.	cwt. per acre.
30 lb. p.a.	25·5	19·3
50 lb. p.a.	24·6	21·0
70 lb. p.a.	24·7	20·8

Grain Section, 1935 only.

Rate of Seeding.	Algerian.	Mulga.
	bus./ac.	bus./ac.
30 lb. p.a.	7·6	11·6
50 lb. p.a.	8·1	12·8
70 lb. p.a.	7·9	11·6

Oat Grazing Trials.

In 1932 preliminary information was gained as to the suitability of various oats for grazing in the Mallee. Last year an extensive oat grazing trial was inaugurated, consisting of two sections—

(*a*) Carrying capacity section to measure the total amount of grazing provided by different varieties of oats, viz.:—Belar, Mulga, Dawn, Lachlan, and Algerian, sown with a combine on stubble ground without manure.

(*b*) Recovery section to measure the growth and recovery after grazing.

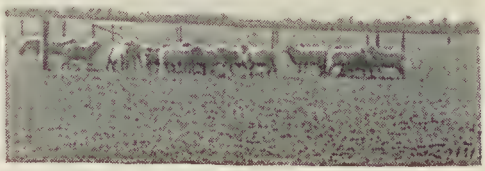
In the carrying capacity section an effort was made to compare the total amount of feed given by the different varieties under test. Six three-acre plots consisting of the five varieties named above, with an extra Algerian check plot, were sown. Each plot was divided into three sections grazed in rotation, corresponding sections of each variety being grazed at each time.

A record was kept of the number of sheep required to eat out each plot to a similar extent. Tabulated below are the sheep days per acre obtained from this experiment in 1935.

TABLE XI.—OAT GRAZING TRIALS.—SHEEP DAYS PER ACRE FROM VARIOUS VARIETIES FROM JULY TO NOVEMBER, 1935.

Variety.	1st Grazing 17.7.35 to 4.8.35.	2nd Grazing 16.8.35 to 31.8.35.	3rd Grazing 25.9.35 to 14.10.35.	4th Grazing 30.10.35 to 14.11.35.	Total.
Belar ..	128	100	120	38	386
Algerian ..	95	102	125	96	418
Mulga ..	104	85	109	44	342
Dawn ..	95	85	123	95	398
Algerian ..	91	95	125	114	425
Lachlan ..	87	97	140	115	439

The results show that most feed early in the year was obtained from the early varieties—Belar and Mulga; but after being grazed these varieties did not recover so well as the others, and provided less feed over the whole period. From the commencement of the first grazing until the oats were finally eaten out—a period of four months—Lachlan carried 3.7 sheep per acre, Algerian 3.5, Dawn 3.3, Belar 3.2, and Mulga 2.9 sheep per acre respectively. This test is being continued this year. To date the variety Dawn has provided the most grazing.



Oat Grazing Trials.

In the recovery section which embraces all the varieties included in the standard variety, and rate of seeding trials, an endeavour is being made to measure the amount of early feed provided, and the ability of the varieties to recover, after being grazed. One set of plots was grazed heavily during July, and another series was similarly grazed, both in July and again in August. All varieties were fed off at the same time, samples being taken before and after grazing. After grazings were completed the plots were left to ripen and were stripped for grain.

Last year it was found that for early varieties of oats, plots which were grazed once had their grain yield reduced approximately 25 per cent. and those grazed twice by approximately 50 per cent. below the yields of the ungrazed plots. The yields from the later varieties, though much lower than the earlier varieties in the ungrazed section, were not so seriously affected by being fed off.

Stud Rows of Wheat and Oats.

In the rate of seeding trials, although the heavier rates provided much more growth of green-stuff for each grazing, at harvest time, neither the Algerian nor Mulga, showed increases in yield due to the heavier rates of sowing. This year the work is being continued, together with more detailed investigations as to the relation between rate of seeding and the amount of grazing provided by oats.

Cereal Breeding and Development.

Each year a number of plants considered to be desirable parents are mated at the State Research Farm, Werribee, the progeny being grown and studied in the nursery rows of the stud cereal section at Walpeup. An opportunity is thus being given the plant breeder to examine the new varieties growing under Mallee conditions. In this way, the various factors which go to make up a prolific variety are studied at an early stage in the life of the new crossbred or selection, and those showing weakness of any description are discarded.

The rows have been subject to drastic culling and selection each year, and some 30 wheat and 10 oat selections have now reached the stage when it is considered desirable to multiply the seed and test the selections in small replicated plots.

In addition to the above several varieties are sown for observation purposes, these including Noongar, Pusa, Geeralying, Riverina, Aussie, Sword, Sultan, Duri, Sutton, Felix, Gular, and Cadia.

Flag Smut Investigations.

This experiment is part of a set of investigations commenced at several centres, including Walpeup, Werribee, Shepparton, Warracknabeal, Rutherglen, and Longerenong. In 1933 the scope of the experiments at the Mallee Research Station was considerably extended to investigate the effect on the disease of many factors, such as time and depth of sowing, pickling, cutting back (or feeding off), and the application of various fertilizers. In addition, an accurate yield trial, sown with infected and clean seed of Nabawa, Ghurka, Federation, and Free Gallipoli, was included to determine the effect of the fungus on the yield of both "resistant" and susceptible" varieties.

Although infection in the field generally takes place from the spores or seeds of the disease present in the soil, experimental tests are made by dusting the grains of the varieties to be compared with spores gathered from diseased plants in the previous season.

The importance of this disease in reducing the possible yield of susceptible varieties is shown in the results of the yield trial which was sown in 1933 with infected and clean seed of four varieties.

TABLE XII.—RESULTS OF YIELD TRIAL, WALPEUP, 1933.

Variety.	Clean Seed.	Infected Seed.
	bus./ac.	bus./ac.
Nabawa (resistant) ..	14·9	14·7
Ghurka (resistant) ..	20·4	17·7
Free Gallipoli (susceptible)	17·5	5·2
Federation (susceptible) ..	13·9	4·4

Wheat varieties differ in the degree of their susceptibility to flag smut, and one of the most promising means of control lies in the direction of breeding varieties which are resistant to the disease. Hence observations on the percentage infection of the disease in rows of the wheat varieties in general cultivation is most valuable.

The varietal susceptibility trial to date has revealed a very promising group of varieties and crossbreds which are comparatively resistant to the organism. The varieties which have been

Portion of the non-infected plot of Free Gallipoli in Yield Trial, Flag Smut Investigations, 1933.

View of the plot of Free Gallipoli infected with Flag Smut—Yield Trial, Flag Smut Investigations, 1933.

tested may be divided into the following groups in accordance with their reactions to the disease :—

Very Susceptible	Indian H Federation Free Gallipoli Sultan Waratah Major Turvey Early Gluyas Mac's White
Susceptible	Nizam Penny Bobin Ranee 4H Yandilla King Rajah Sepoy
Moderately Resistant	Joffre Ford Currawa
Resistant	Sword Ghurka Curr. x Ind. E. x Telfords Dundee Dan Bencubbin Carrabin Florence Geeralying Nabawa Rajah x Gallipoli W7495 H1-1-7-3-2 Cedar Dindiloa

All the commonly grown varieties, and many new crossbreds have been classified similarly.

The work of field testing new crossbreds for flag smut resistance has now been transferred from the State Research Farm, Werribee, to this Station, where it is found that conditions are more favorable to the development of the disease.

The results of the other trials which were sown have shown that various factors play an important part in influencing the degree of infection. In addition to the standard methods of control such as the burning of infected stubbles, fallowing, and rotation of crops, it has been shown that adequate manuring with superphosphate, and efficient pickling with copper carbonate tend to reduce the losses caused by this disease.

The most important result of this investigation has been the discovery that the Ghurka variety, which is a prolific yielder under ordinary conditions, is also resistant to Flag Smut, and its use is recommended for sowing on areas where yields have been reduced by this disease.

Pastures and Forages.

A feature introduced in 1934 was the establishment of a small pasture plant nursery. In this, seeds of drought-resistant species obtained from various parts of the world, are being tested. Observations are made on their growth, persistence

In the Pasture Plant Nursery—promising grasses for the Mallee—left, Ehrharta calycina; right, Wimmera rye-grass (new, early maturing selection).

and suitability for Mallee conditions. So far the most promising is Perennial Veldt grass (Ehrharta calycina), which is drought-resistant, staying green till late in the summer and providing a good body of succulent feed. Several other plants are showing definite promise, and will be sown on larger areas next year. In addition to the introduced species, early selections of Wimmera rye-grass and subterannean clover are being tried. Some of these selections are making better headway than the usual strains obtained commercially. Arabian or Kelch grass (*Schismus barbatus*) has also shown promise as an annual grass superior to barley grass, and may be useful in binding sandy land.

In addition to the value of cereal crops for grazing, attention is being directed to the development of other types of forages. Great success has been attained in the drier portions of Western Australia with Blue Lupins, which have been sown down with considerable success in that State. Seed was imported into Victoria early in 1933, and plots sown down at Walpeup proved very satisfactory that year. Further trials since that time have not been so encouraging, as with the summer rains self-sown Lupin seed germinated, and the plants died in the dry periods. Similar interest has been shown in the development of various species of saltbush as a fodder, and preliminary trials with one of these, *Atriplex semibaccatum* (Trailing or Berry Saltbush), have given encouraging results, but when tried on a larger scale on stubble ground germination was not good. Further tests will be made to establish this plant on fallowed land. Trailing saltbush which is reputed to be a good sheep feed, though eaten by stock, is not particularly relished.

Lucerne sown on fallow last year germinated well, persisted through the summer, and gave good growth readily eaten by stock. Owing to its deep-rooted habits, this plant once established has definite possibilities.

Christmas Mails

For United Kingdom and Europe

The postal authorities have intimated that, in order to ensure delivery before Christmas of parcels for persons in the United Kingdom and Europe, it is necessary that they should be posted in time to reach the General Post Office, Melbourne, before noon on Monday, 9th November, 1936, when the mail closes for despatch per the R.M.S. *Orion*.

The packet mail for despatch by the *Orion* will close at the General Post Office, Melbourne, at 3 p.m. on 12th November, 1936, and the letter mail at 4 p.m. on that date.

The last mail for letters and packets for delivery before Christmas in the United Kingdom and Europe will be despatched per the R.M.S. *Maloja*. Packet mails will close at Melbourne at 3 p.m. on the 19th November, 1936, and letter mails at 4 p.m. on that date.

Although the *Maloja* mails will reach London on 19th December, 1936, the public is exhorted to post, so far as is practicable, Christmas mail for the United Kingdom and Europe in time for despatch per the R.M.S. *Orion*, as there will be a large accumulation of mail matter for delivery in the United Kingdom and Europe during the Christmas week.

It is desired to emphasize that, as in the case of parcels, senders of small packets are required to fill in and affix thereto a declaration form indicating the nature and value of the contents. Parcels and small packets must not be posted in the ordinary way; they must be handed in over the counter of a post office.

Weeds in Irrigation Ditches

Methods for their Control

By A. Morgan, B.Agr.Sc., Irrigation Field Officer

ALTHOUGH the value of irrigation water is indisputable, there can be no doubt that its influence on the spread of weeds has been an undesirable feature of its use. The term "weeds," in this respect, needs some explanation, since the great majority of the plants concerned are not normally regarded as noxious, and are not to be found among those listed as proclaimed weeds. The commonest and most troublesome weeds in the ditches on the average irrigation block are Paspalum (*dilatatum*), Water Couch (*Paspalum distichum*), Rushes, Sedges, Docks, Barnyard grass (*Echinochloa crus-galli*)—"Wild Millet" in the North—Pigeon grasses (*Setaria* spp.), Umbrella grass (*Chloris truncata*), Blown grass (*Calamagrostis filiformis*), and plants such as Loosestrife (*Lythrum hyssopifolium*), Red-flowering Mallow (*Modiola caroliniana*), Stonecrop (*Crassula* spp.), Ranunculus species, and so on, with occasional infestations of noxious weeds such as Hoary Cress, Wild Chicory (*Cichorium Intybus*), and Bulrush or Cumbungi (*Typha latifolia*).

A built-up channel, showing effect of draining out and grazing by stock in the control of weeds.

The most troublesome feature of vegetation in ditches is the holding up of water, lengthening the time that is usually only grudgingly given to the frequent applications in summer, and in many cases necessitating the constant building up of banks and so on to obtain an even and economical distribution of water. Further, as a harbour for water snails, the intermediate hosts of liver-fluke, vegetation in ditches constitutes a menace to stock. In many areas subject to salt or alkali, seepage of water from channels introduces the risk of a raised water-table and consequent damage to or death of the root-systems of fruit-trees, crops, and pastures, and any interruption to the flow of water naturally increases this risk.

Under the circumstances, we can for the purpose of this article define a "weed" as any plant which impedes the flow of water, and naturally the term "channel" or "ditch" is restricted here to one constructed by the irrigationist to serve the needs of his own block, as distinct from the large channels constructed and controlled by the State Rivers and Water Supply Commission.

On many blocks, particularly in earlier settlements, the users of irrigation water, having no previous experience to guide them, constructed channels which were ideal for the establishment and distribution of weeds. Wide, shallow channels were constructed with scoops, and lateral channels were ploughed and cleaned out with the delver. In both of these types the bottom of the channel was unavoidably well below the level of the top end of the paddock irrigated from it, and after watering was concluded there was no way of draining out the channel properly. With water lying in the channel practically all the year round, it is no

A dug-out type of channel which has not been drained out or grazed over by stock, resulting in a vigorous growth of weeds.

wonder that aquatic and semi-aquatic species became firmly established and, while the difficulty of drainage remained, defied all attempts at eradication, except by the laborious process of digging them out, which at best gave only temporary relief.

The continued rapid expansion of irrigated pastures and lucerne shows that there is ample opportunity for the avoidance of a repetition of the weed problem in ditches, by building up the channels, rather than digging them out. By deposition of soil along the line of the intended channel, and splitting this line of dirt to make the banks, a channel can be constructed so that the bottom is at the same level as the top of the paddock. Such a channel can be effectively drained out, thus removing to a great extent the primary cause of the luxuriant growth of semi-aquatic species. On the banks of this built-up channel stock can graze, and, in fact, the bottom of the channel is usually kept grazed, which is a cheap and efficient way of preventing the weeds from making enough growth to impede water flow. Naturally, some establishment of paspalum, water couch, rushes, sedges, and docks is unavoidable, but apart from the lesser infestation and growth which occurs on the built-up channel, the periodical clean-out of a channel, which can be emptied, involves much less work than where the job has to be done working in water.

Even where channels can be drained out, water is often left in them for stock, and in most cases practical considerations of this sort are more to the point than strict adherence to conditions which will minimize the growth of weeds in the channels.

Even with the best type of channel, as recommended above, the shovel still remains the most efficient method of making the necessary periodical clean-out. There is no doubt that the top growth of any plant can be burned off with light applications of chemicals, but as a result of detailed experimental work in Victoria and elsewhere, it can be definitely stated that the root-systems of sprayed plants growing in a waterlogged environment are not affected by such treatment unless the amount of chemical applied is sufficient to saturate the soil sufficiently to prevent all plant growth. Such a saturation —technically termed "soil sterilization"—with sodium chlorate or calcium chlorate is prohibitive in cost, and, although sodium chlorate is relatively non-poisonous as compared with arsenical compounds, it can produce an incurable jaundice in live stock if ingested in any amount. The possibility of this occurring on a dairying block where the channels have been sprayed would be too high, as it is necessary to shift the cows on to a new paddock every few days.

A channel protected from grazing, with consequent growth of paspalum and other weeds.

Where top-growth is removed by chemicals and root-growth is unaffected, the treatment is temporary in effect, and such a temporary effect in no way justifies its cost. There are also some soil types in the irrigation districts on which it would be inadvisable to completely denude the channel banks of vegetation or they would be trampled down so badly by stock that the labour of re-forming the banks would be as much as that involved in cleaning out the channel with the shovel. As a further consideration, the spraying of chlorates in channels on fruit-growing blocks would be attended with risk, as shown by the bad effects of spraying weeds in banana plantations with this chemical.

The use of any arsenical compound is not recommended. With the chlorates, the chemical is finally leached out of the soil with rain and irrigation water, but with the arsenical compounds there is a fixation of the poison in the top few inches of soil and they defy the leaching effect of rain and irrigation to remove them. Where the quantity used is sufficient to sterilize the soil, the top few inches will remain in a highly poisonous state for years unless the chemical is turned under by deep ploughing or cultivation.

The problem of weeds in channels has been tackled very thoroughly in California by the authorities responsible for the maintenance of the main delivery channels, and the following statement appears in an account of this work, dated February, 1936, under the heading "Weeds in Ditches and Water-ways":—

> "Along cement-lined ditches, in certain soils, chemical treatment has been economical and effective in controlling weeds. Soil sterilants, however, are of no use below the waterline of unlined ditches in any soil, and in the heavier recent alluvial soils they are required in excessive dosages above the waterline. In such cases mechanical control seems best."

A further account is then given of the type of machinery used on a large scale for the work of mechanical control.

Although under dry soil conditions chemical control has given good results in experimental work, to obtain the dry soil conditions essential for success is a practical impossibility on irrigated blocks, no matter whether the channel is capable of being drained out or not, since the intervals between the frequent waterings necessary in summer are too short to allow any great amount of drying out, except of the surface soil, and in winter when the channels are not in use the temperatures are too low for adequate evaporation and rainfall, whenever it occurs, replenishes the soil moisture in channels to an even greater amount than on the rest of the paddock owing to their bigger catchment area.

From the available facts, one is forced to the conclusion that the practical means of control of weeds in ditches are limited to the construction of the built-up type of channel, and periodical cleaning out with the shovel when grazing fails to give adequate control, while, with the dug-out type of ditch, there is nothing as yet capable of superseding shovel work. As to the possibilities of the flame-thrower, these require full investigation before any definite information as to its effectiveness can be given.

Tubercle Free Herds

The following herds have been declared free of tuberculosis under the scheme conducted by the Department of Agriculture. Under this scheme a tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

ACCREDITED TUBERCLE FREE HERDS.

Herd Number.	Name.	Address.	No. in Herd.	Herd Number.	Name.	Address.	No. in Herd.
1	State Research Farm	Werribee ..	259	6	Lady Talbot Milk Supply Company	Cranbourne ..	418
2	Warragul High School	Warragul ..	35				
3	Payne, A. E. T. ..	"Yarra View," Lilydale	80	7	Mailer, Dr. Ramsay ..	"Mancroo," Shepparton	92
4	Dennis, Mrs. A. A. ..	Frankston ..	14	8	Reid, Ralph G. ..	"Holmwood," Koo-wee-rup	99
5	Slaney, H. B. ..	Mornington ..	85				

Bacterial Canker of Tomatoes

By S. Fish, M.Agr.Sc., Biologist, and A. T. Pugsley, B.Agr.Sc., Assistant Plant Pathologist.

"BACTERIAL Canker" — a wilt disease of tomatoes has been known for many years in the United States of America, where it is regarded as one of the major diseases of this crop. Following an outbreak of this disease in New South Wales last year, we have now unfortunately to record its appearance in Victoria.

The purpose of this article is to describe the main features of bacterial canker so as to assist growers in recognizing the trouble and, in addition, to summarize the measures recommended for its control.

Symptoms of Bacterial Canker.—The disease is most easily recognized by its effect on the leaves of the plant, the damage being the result of the invasion of the water conducting vessels or vascular system of the plant by bacteria.

The first symptoms usually appear on the lower leaves; the disease progressing upwards as a slow wilting, browning and dying of the leaves which remain attached to the plant. It is very common to find only one side of the plant attacked and frequently the leaflets on one side of a leaf are brown and shrivelled, while others on the same leaf appear normal. (See illustration.) Infected shoots are usually stunted. If an infected leaf-stalk or stem be cut across then a yellowish discoloration can be seen just inside the woody cylinder, and in the later stages cavities in the stem may be produced by the separation of the pith from the outer wood.

Two phases of the disease are worth mentioning although they do not always make their appearance. They are firstly, the splitting of the stem and leaf stalk to form cankers, and secondly the spotting of the fruit, a symptom which is found only in wet seasons.

Control measures.—Bacterial canker furnishes an outstanding example of the importance of obtaining disease-free seed, so that if only such seed is planted in disease-free soil then no trouble from the disease should be encountered.

Tomato leaf showing infection of one side only.

The causal bacterium is transmitted within and on the surface of the seed, and it is by this means that the disease is brought into new areas.

Seed, therefore, should be saved only from healthy plants and, as a further safeguard, they should be extracted by fermentation with the pulp without water for at least two days. Before sowing seed of unknown origin it should be treated with mercuric chloride (corrosive sublimate) at a strength of ¼ oz. in 5 gallons of water. Treat for five minutes and then wash in water for ten to fifteen minutes.

Once bacterial canker has made its appearance in a field the soil becomes infected and serves as an additional means for the carry over of the disease from season to season. Destruction of diseased plant material, together with the rotation of crops, will help to eliminate this soil infection.

[*Continued on page 528.*

Permanent Pasture Mixtures

Species Recommended

By J. E. Harrison, B.Agr.Sc., Agrostological Research Officer.

PERENNIAL rye-grass, cocksfoot, Phalaris tuberosa, white clover and subterranean clover are the species mainly employed in compounding permanent pasture mixtures. Two or more of each are generally used, chiefly according to the ability of the climate and the soil of a district to maintain them. The scope of each species is limited by the extent of its adaptation to a certain environment. Each has a degree of elasticity which allows it to range across the full breadth of that environment, which may be from light to moderate rainfall, or moderate to heavy, and from sands to loams or loams to clays; but it is definitely restricted within these limits. It is thus of importance to appreciate the chief characteristics of the above principal pasture species if each is to be employed in its proper place, and to the best advantage.

Perennial rye-grass is adapted to soils of heavy or medium texture, and makes its growth during autumn, winter, and spring; but is dormant during summer. It is suppressive of other plants, and should be used in small or moderate proportions, if the presence of other grass species is desired to any extent. On suitable soils and in favorable situations it will form a permanent pasture in areas receiving as little as 20 inches of rain annually, though for general purposes on a wider range of soils about 25 inches or more appears to be required.

Cocksfoot prefers deep, free loams and peaty soils, though it also thrives well on somewhat heavier classes of soil. It is valuable for its summer and autumn growth, as well as its spring production, and as it is, by nature, a summer grower, it requires fair summer rains. In the Gippsland hills it is often described as the "dry-weather grass," though it must be stated that the Gippslander's conception of dry weather is not quite the same as that of farmers in other parts of the State. Cocksfoot is at its best in areas receiving 40 inches or more of rainfall a year, where it forms a highly productive pasture under favorable summer conditions. Apparently it would also form a satisfactory pasture on certain soils in areas receiving 30 inches or even less, but it would be necessary to give it greater protection during the summer months if it were not to succumb to over-grazing. The fact that it gives a green summer bite renders it highly susceptible to selective grazing in areas like Central Victoria and the Western District, where the summer is dry and every green blade is sought after. If not protected more than usual under such conditions cocksfoot is very vulnerable, and is seriously weakened, and even killed, by continuous grazing.

Phalaris tuberosa is adapted to heavy clay soils and to light soils having a heavy clay subsoil within 15 or 18 inches of the surface. It demands high soil fertility for leafy growth, and it is possible that many soils now unsuitable will maintain it satisfactorily, when their fertility has been raised by the cultivation of subterranean clover, for a few seasons.

Phalaris is more drought resistant than perennial rye-grass and, on the other hand, will withstand flooding and wet conditions better, once it is established. It is not equal to perennial rye-grass in soils which suit this latter species, and its principal sphere of usefulness will no doubt be found in those drier districts where perennial rye-grass fails to persist. As it commences growth later in the autumn and makes more winter growth than perennial rye-grass and sustains it longer into the spring, it should also be useful for a change of pasture in rye-grass districts.

Its use in all districts is limited at the present time by the high cost of seed and the difficulty in securing a strike. The plant is extraordinarily difficult to establish except on very clean land; it is slow to germinate, is a tardy grower in the first year and sensitive to competition from other plants. As a mature plant it is extremely resistant to competition and maintains its hold on the soil against all other species. It does not spread from field to field like rye-grass and subterranean clover, and must be sown down to become established in those places where it is wanted.

White clover is adapted to moist conditions. It prefers the same class of soil as rye-grass, and

A general view of the perennial rye-grass strain trials at Burnley.

the fairly heavy and well-distributed rainfall favorable to cocksfoot. It is thus usually found associated with rye-grass under very good conditions, and this gives the key to the pasture mixtures in which its inclusion would be most suitable.

There is an important point concerning white clover in pasture management which should not be overlooked. It is a lowly creeping plant which is largely crowded out by tall growth, and is, for example, seriously checked by a hay crop. Close grazing is therefore desirable to maintain white clover in plentiful proportion in a pasture, so that it may make a liberal contribution to the composition of the sward.

Subterranean clover exhibits adaptation to very wide differences in rainfall. Though it definitely prefers free loamy soils for maximum growth, it grows under all conditions with rye-grass or cocksfoot where white clover is a doubtful or definitely negative quantity. It is capable of good growth also on lighter soils and in areas of lighter rainfall than perennial rye-grass, and is thus often found as companion plant to our native wallaby grass or Danthonia, and to annual grasses such as goose grass (*Bromus mollis*), spear grass (*Bromus sterilis*), and Wimmera rye-grass (*Lolium subulatum*). It makes exceptional response to phosphatic top-dressing.

Subterranean clover is an annual, and arises as a self-grown crop each year, providing valuable winter as well as late autumn and spring feed. If good winter growth is to be obtained, the young plants should receive protection in autumn to give them an opportunity to become well established and deeply rooted before winter sets in.

Strawberry clover is a creeping perennial clover which grows in spring, summer, and early autumn. It is adapted to heavy flat soils which are wet in winter and moist in summer, and though important in its place, its usefulness is restricted to small areas along rivers, creeks, and "black leads" in the better rainfall districts. It is slow to establish, both from seed and from the more usual method of heeling in runners. Though commonly regarded as appreciating a salty soil, it seems more correct to say that it is tolerant of salty conditions more than other common pasture plants, and grows equally well, if not better, in the absence of salt.

Temporary Species.

Grasses.

Suitable strains of short-lived rye grasses are available for inclusion in a seeds mixture as cover crops to other grass and clover seeds. They have the advantage of being ready growers and of tending to suppress weed growth in a young pasture, while their disappearance in the second or third year makes room for clovers and slowly-developing perennial grasses.

Italian rye-grass is suited to districts of good rainfall (30 inches or more) and late springs; it is highly productive, palatable and nutritious, and

is readily grazed by stock. It makes good winter growth, but rather less than the next two species, which however do not remain green as late in the spring.

New Zealand South Island rye-grass resembles Italian rye-grass in habit but its seeds have no awn or bristle. It consists of a mixture of annuals and longer-lived plants, makes good winter growth, and is palatable and nutritious. It could be used as a cover crop, as a substitute for Italian rye-grass, in districts of good rainfall, and could probably replace it altogether with advantage in districts receiving a rainfall of 25 inches or less.

Wimmera rye-grass differs from the other two rye grasses in being strictly annual and earlier to flower. It makes very good winter growth. It could be used as a cover crop in districts of fair rainfall, or as a temporary grass element in districts of low rainfall where the perennial kinds will barely persist. In such cases it may be permanently maintained as a self-sown crop by light cultivation every second or third autumn.

Clovers.

There are two clovers which make relatively good growth in the first year. They are useful in increasing the amount of grazing and in providing a better balance of clover to grass in a young pasture. Both are sensitive to prolonged dry summer weather, and are suitable only for districts of good rainfall.

Red clover is suited to deep, free, well-drained soils and appreciates a good summer rainfall. It is winter dormant but makes good growth at other seasons. Individual plants usually last three or four years, but the species may persist for a longer period by re-seeding.

Alsike clover is suited to stiff damp clay soils. It requires much the same rainfall as red clover, is rather less productive, and matures somewhat earlier in the spring. Individual plants are said to live longer than those of red clover.

Mixtures and Quantities.

The rate of sowing depends upon many factors, and perhaps as much upon the purse as any other. If the soil is in very good order, less seed is required than for a rough seed-bed, and a saving may be made in this way. If seed has a high germinating capacity as well as a rapid one, still less seed need be sown. This advantage may be offset to some extent by a slightly higher price for such seed, but the difference is usually to the farmer's advantage, and it pays to buy good seed. An early sowing may also be somewhat lighter than a late one, and it is an advantage for the sake of economy as well as for the best establishment of a pasture to sow reasonably early in the autumn.

It is customary—and the custom appears to have a sound basis—to sow more heavily in some districts than others. The heaviest and most expensive sowings are made in Central and South Gippsland, Beech Forest, and such places where rainfall is heavy. Not only are more comprehensive mixtures possible in these moist and fertile areas, but also weeds are usually more abundant and heavy seedings are more desirable to combat them. In areas of moderate rainfall, where simple mixtures are used, and weeds are not so troublesome, it is a common matter to sow down at a cost of 10s. per acre or less; whereas in areas of high rainfall, where more complex mixtures are the order of the day, and where weeds are more competitive, it usually costs from £1 to £1 5s. or more per acre.

A common mixture in areas of about 25-in. rainfall, in which lie the better pastoral areas of the State, is the following:—

		s.	d.
Perennial rye-grass ..	10 lb. at 10s. per bus. ..	5	0
Subterranean clover ..	2 lb. at 1s. per lb. ..	2	0
	12 lb. per acre. Cost =	7	0

It is a frequent practice to sow oats for hay the first year, and broadcast subterranean clover seed

Single plants of rye-grass showing comparative growth at the end of the first winter. 1. Victorian; 2. New Zealand uncertified (note stemmy growth); 3. New Zealand certified; 4. Irish, imported.

as soon as the oats are sown. The clover becomes well established, and seeds freely in the oat crop, leaving sufficient seed in the soil to provide a good stand for the next year, when perennial rye-grass is introduced by drilling in about 10 lb. of seed per acre on the stubble across the old oat rows.

The same mixture of perennial rye-grass and subterranean clover is sown down in various proportions and in various quantities throughout the 25-in. to 30-in. rainfall belt of the State, though not often in greater amount than the following :—

		s.	d.
Perennial rye-grass	20 lb. at 10s. per bus.	10	0
Subterranean clover	5 lb. at 1s. per lb.	5	0
	25 lb. per acre. =	15	0

Lucerne, at the rate of 2 or 3 lb. per acre, is sometimes introduced with advantage, particularly on deep, free, well-drained soils. Strawberry clover and white clover are often added, and may even displace the subterranean clover on heavy moist flats, but the perennial rye-grass—subterranean clover combination must be regarded as the best all-round and least expensive general-purpose mixture known for our intermediate areas at the present time. Many farmers sow rye-grass only, and wait for volunteer clover growth—cluster, suckling, knotted, and other annual clovers—to appear, and provide the legume content of the pasture. In this connexion it is interesting to note that the first of these, cluster clover, is increasing in popular regard, and flowing more freely in commercial channels, especially in Central Victoria, where it is regarded as being very suitable to the district.

In districts of 20-in. to 25-in. rainfall, Phalaris tuberosa is worth trial on the heavier and more fertile soils. If a summer fodder crop of millet or sudan grass can be grown, the land is freed from weeds and may be prepared in good order for seeding down by light surface cultivation in the autumn. The following mixture has been found satisfactory :—

		s.	d.
Phalaris tuberosa	4 lb. at 4s. per lb.	16	0
Subterranean clover	4 lb. at 1s. per lb.	4	0
	8 lb. per acre. =	20	0

In 30-in. rainfall country, the possibility of introducing cocksfoot arises, but there are difficulties associated with its inclusion. If sown with much rye-grass it encounters intense competition ; if grazed continuously during the summer it is seriously weakened, and if a long dry summer prevails it loses its hold, and may die or be pulled or knocked out. It therefore seems necessary in such areas, if cocksfoot is to play a part, to sow it either separately or with little rye-grass, and graze it intermittently during the summer. A mixture suggested is—

		s.	d.
Cocksfoot	10 lb. at 1s. per lb.	10	0
Perennial rye-grass	5 lb. at 6d. per lb.	2	6
Subterranean clover	3 lb. at 1s. per lb.	3	0
	18 lb. per acre. Cost =	15	6

NOTE.—The perennial rye-grass may be replaced by Italian rye-grass.

The value of cocksfoot in such areas lies in the amount of green feed it might produce during the dry summer months. The value of lucerne in this respect, however, is unsurpassed, and though cocksfoot might be successfully sown down in a field or two, the present tendency of farmers to adopt lucerne as the plant to fill the gap between spring and autumn in the supply of green feed has much to commend it.

In the 25-in. to 30-in. rainfall belt, there are moist soils and situations where white clover and strawberry clover command attention, and should be included in the mixture, as, for example, as follows :—

		s.	d.
Perennial rye-grass	15 lb. at 6d. per lb.	7	6
White clover	1 lb. at 3s. per lb.	3	0
Strawberry clover	4 oz. at 6s. per lb.	1	6
Subterranean clover	2 lb. at 1s. per lb.	2	0
	18¼ lb. per acre. =	14	0

Some farmers prefer to omit subterranean clover from such situations, and increase the amounts of white and strawberry clover. This is a matter of judgment, and of knowledge as to the suitability of a field to these species. If the subterranean clover be omitted, and top-dressing is practised, a volunteer growth of various clovers will normally arise within a few years if the white and strawberry should fail.

In the areas of high rainfall, 35 inches and over, careful appreciation of the requirements of each species is needed if a thoroughly satisfactory mixture is to be compounded. The soil preferences and water requirements of each species should be carefully considered before deciding what to sow in a field, or in fact in different portions of a field. For example, white clover is selective of moist patches, and subterranean clover

Harvesting perennial rye-grass in Victoria.

of dry places; rye-grass exhibits a preference for heavy, well-compacted soils, and cocksfoot for deep and porous soils. In a general way rye-grass and white clover show adaptation to similar areas under high rainfall, and so also do cocksfoot and subterranean clover, but there are exceptions to this rule. It is, however, a very useful guide, and mixtures may, with a reasonable assurance of success, be compounded according to the following directions :—

For heavy soils—		s.	d.
Italian rye-grass	5 lb. at 4½d. per lb.	1	10½
Perennial rye-grass	15 lb. at 6d. per lb.	7	6
White clover	3 lb. at 3s. per lb.	9	0
	23 lb. per acre. Cost =	18	4½

For deep porous soils—		s.	d.
Italian rye-grass	5 lb. at 4½d. per lb.	1	10½
Cocksfoot	15 lb. at 1s. per lb.	15	0
Subterranean clover	4 lb. at 1s. per lb.	4	0
	24 lb. per acre. Cost =	20	10½

For general purposes on heavy to medium soils—		s.	d.
Perennial rye-grass	10 lb. at 6d. per lb.	5	0
Cocksfoot	10 lb. at 1s. per lb.	10	0
White clover	2 lb. at 3s. per lb.	6	0
Subterranean clover	2 lb. at 1s. per lb.	2	0
	24 lb. per acre. Cost =	23	0

For general purposes on medium to light soils—		s.	d.
Italian rye-grass	5 lb. at 4½d. per lb.	1	10½
Cocksfoot	10 lb. at 1s. per lb.	10	0
Perennial rye-grass	5 lb. at 6d. per lb.	2	6
Subterranean clover	3 lb. at 1s. per lb.	3	0
White clover	1 lb. at 3s. per lb.	3	0
	24 lb. per acre. Cost =	20	4½

Many farmers like to include in the above four mixtures for heavy rainfall areas temporary clovers such as—

		s.	d.
New Zealand cowgrass	2 lb. at 1s. 6d. per lb.	3	0
Alsike	2 lb. at 1s. 3d. per lb.	2	6
	4 lb. per acre. Cost =	5	6

The object is to secure more clover feed quickly in the first season, and better summer growth during the first summer or two.

The mixtures given are intended only as a general guide to those in doubt as to what grasses and clovers to sow down. Special plants such as Paspalum, crested dogstail, Timothy, Lotus major, and the like, have been excluded from the discussion because of their unsuitability for general purpose requirements. The prices also are approximate, but conform reasonably closely to those ruling at the moment for seed of high quality.

Consideration of the subject of pasture establishment could scarcely take place without reference being made to the desirability and importance of top-dressing. The phosphatic requirements of young crop plants such as the pasture species are very high, and vigour and health are influenced by the presence of a readily available supply. The rate of application of superphosphate varies from 90 to 180 lb. per acre, according to the average annual rainfall, the heavier rates being applied in the districts of higher rainfall.

Principal Strains of Pasture Species.

Every pasture species consists of a number of strains, which differ from each other in leafiness, period of growth, time of flowering and length of life. As these differences result in one strain being more adaptable than another, to certain climatic and soil conditions, it is necessary to

understand the characters of the various principal strains if the most suitable for each district and for each purpose are to be used in pasture establishment.

The following list enumerates the principal strains at present in use and sets out briefly the characters of each strain :—

Perennial Rye-grass.

Victorian strain.—A persistent type, having high adaptation in those districts receiving about 25 inches of rain, or more, annually. It makes quick growth in late winter and early spring; is able to remain dormant during the summer, and afterwards grow rapidly with the first autumn rains. Seed is harvested around Colac, Kyneton, and Clunes, and at each of these centres there is an association of growers whose fields have been approved by the Department of Agriculture as suitable for the production of seed.

New Zealand certified strain.—A persistent type, which commences growth later and matures somewhat later than the Victorian strain. Though it makes relatively little winter growth, it tends to be green in summer, and is more suitable for districts of high rainfall (40 inches) than for those receiving more moderate amounts.

Irish strain.—Though a true perennial rye-grass, this strain is not persistent in Victoria, apparently because it has little capacity to remain dormant for any long period during the summer. There is little seed on the market and the quantity steadily declines.

Short-lived Rye Grasses.

Though strains are known to exist in each short-lived species of rye-grass, they have not yet reached the market in commercial quantities. The notes which follow, therefore, relate to average commercial lines only.

Wimmera rye-grass is an annual which makes very good winter growth and matures early in the season. It may persist from year to year by re-seeding if cultivation is practised.

New Zealand rye-grass or South Island rye-grass consists mainly of annuals with a small number of longer-lived plants. It is a good winter grower and matures later than Wimmera rye-grass.

Italian rye-grass consists of a mixture of annuals and biennials. It makes very fair winter growth, makes heavy spring growth, and matures later than the New Zealand uncertified rye-grass.

Cocksfoot.

Victorian strain.—A leafy, persistent type, with a period of growth naturally conforming to the normal occurrence of favorable conditions in the centres of high rainfall in Victoria. Seed is harvested mainly at Korumburra and in other parts of Gippsland, and at Apollo Bay in the Western District.

New Zealand certified strain.—A leafy persistent type, with shorter, straighter leaves than the Victorian strain, commencing growth later and maturing somewhat later in the spring.

The uncertified seed from New Zealand usually gives rise to less leafy and more stemmy plants than the certified seed.

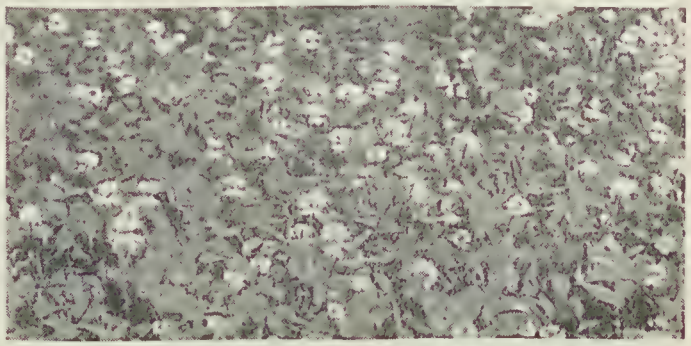
Danish cooksfoot.—An upright, stemmy strain, dormant in winter, and green in summer. As its period of growth does not conform well to normal climatic conditions here, its persistence is always doubtful. Seed is imported from Europe, and as an import regulation necessitates the staining of 1 per cent. of the seeds of a sample a bright red colour, it is distinguishable by their presence.

Phalaris Tuberosa.

Phalaris tuberosa, Burbank's selection, is the only strain which has been differentiated in the seed trade from the bulk of seed on the market. Burbank's selection, which is certified by the New South Wales Department of Agriculture, is a relatively leafy, late-maturing strain, with broad succulent leaves.

Phalaris tuberosa is otherwise regarded as consisting substantially of the one strain, or of closely similar strains. It commences growth later than perennial rye-grass in autumn, and continues it longer into the winter. It matures later than perennial rye-grass, while Burbank's selection matures later still.

Seed harvested in New South Wales is certified by the Department of Agriculture of that State.



Victorian irrigation white clover a rapid and vigorous grower.

Strawberry clover plots in the Burnley Plant Research field. Left, Palestine—a spring flowering strain; Right, Victorian strain—summer flowering.

Seed is harvested in Victoria from fields approved by the Department of Agriculture.

White Clover.

New Zealand certified strain.—A persistent, dense, leafy strain of middle height and the best available at present for sowing down in permanent pasture in districts of high rainfall in this State.

Victorian irrigation strain.—A persistent leafy strain of relatively tall stature, and a rapid and vigorous grower, showing high adaptation and great productivity under irrigation in this State.

White Dutch clover.—A stemmy and free seeding strain. Dormant in winter, it makes runner development late in the season, when the runners do not take root freely and die off in dry weather.

Subterranean Clover.

Dwalganup, certified by the Western Australian Department of Agriculture, is a very early strain, relatively leafless, with long runners. It could be suitable only for those districts of Victoria where the rainfall is light and the seasons are short, and is not to be preferred where any later strain will flourish.

Mt. Barker is a midseason strain, fairly leafy and with runners of medium length. It comprises the bulk of the seed of commerce, and is eminently adapted to districts of intermediate rainfall (20 inches to 25 inches).

Tallarook is a very leafy, late-maturing strain with relatively short runners. At Tallarook it is growing principally on river flats, with an average annual rainfall of 23 inches. Under less favorable soil conditions, a somewhat higher rainfall would probably be needed for the full development of this strain. Seed is harvested in Victoria from fields approved by the Department of Agriculture for the purpose.

Strawberry Clover.

New Zealand strain is late to commence growth in the spring and to flower in the summer. In its proper habitat it is persistent and fairly leafy, though the leaves are small and the plants are low growing. Most of the seed of commerce belongs to this strain.

Victorian strain, in general, grows more freely and flowers earlier than the New Zealand strain. Unfortunately seed seldom comes on the market, and the best method of establishment is to gather runners and heel them in during September.

Red Clover.

New Zealand cowgrass is a rapid growing, early-strain. Though seed is not certified, most of the red clover seed which is harvested in the Dominion belongs to this strain. It is well adapted to districts of high rainfall in Victoria, and is probably the most productive of the red clovers in use here. It is usually in full bloom by mid-November.

European red clover is usually in full bloom by the beginning of December. It is not a vigorous grower and is less productive than New Zealand cowgrass.

Montgomery red clover is a leafy, late-maturing strain, recorded as a desirable pasture plant, and also as suitable for a late crop of hay. It is usually in full bloom by mid-December and may be useful in providing green feed later than the main pasture flush in spring. It is at present under trial in Gippsland.

ALSIKE.

There are no recognized strains of this species on the Australian market.

Bacterial Canker of Tomatoes (Continued from page 520.)

It is strongly recommended that growers who have not yet encountered this trouble should plant only seed from clean plants or, alternatively, seed which has been treated with mercuric chloride.

Identity of the Causal Organism.—Although Samuel (1) recorded a bacterial wilt on tomatoes resembling bacterial canker from South Australia in 1924, no final identification with the American disease caused by *Phytomonas michiganensis* was made. The first authentic outbreak of bacterial canker in Australia was reported last year (1935) by Magee (2), who stated that it was already causing concern in some districts in New South Wales.

During the early part of this year the presence of the disease in Victoria was brought under the notice of this Department. A small gram positive bacterium was isolated in pure culture from diseased material and gave the following reactions:—On agar slow-growing colonies, pale at first, becoming yellow. Medium diastatic action on starch agar. Gelatin liquefied. Dry spreading growth on potato cylinders. Litmus milk decolorised and clotted. Pathogenic to the tomato (*Lycopersicum esculentum*). The pathogen is thus identified as *Phytomonas michiganensis* (E. F. Smith) Bergy et al.

References.

(1) G. Samuel Annual Rept. of the Lecturer in Plant Pathology. Abst. Rev. Appl. Myc, v. 5, p. 213. 1926.
(2) C. J. Magee. Bacterial Canker of Tomatoes. Agric. Gaz., N.S.W., v. 46, p. 192. 1935.

Book Review

Flour Milling Processes—by J. H. Scott.

(1936, 413 pp., illustrated, 21s. sterling, Chapman and Hall, London.)

The raw material used in flour milling is of constantly varying quality, and exact information on the complex process is therefore highly desirable but somewhat difficult to obtain. The author, an engineer and miller connected with the world-famous firm of Henry Simon Ltd., has had unique opportunities of studying the subject in numerous mills under widely differing conditions. His book is the outcome of these experiences, and of the author's own experiments, and represents a decided acquisition to the literature in English on the subject of flour milling.

The first part of the book is devoted to wheat treatment prior to the actual milling operations. A general outline of the various cleaning and washing processes is followed by a discussion of the various machines designed to carry out these processes, e.g., separators, scourers, washers, aspirators, &c. Theoretical and practical considerations involved in wheat conditioning are very fully considered, and there is a chapter on bushel weight—its determination and significance.

The second and longer part deals with flour milling. The design and use of break rolls is dealt with in some detail. A discussion of scalping and grading leads to the question of smooth-roll reduction and flour dressing. Possible and actual flour yields are discussed, together with the various factors influencing yield. The characteristics of various flours and mill stocks are described, and the final chapter deals with the new development of water-cooled rolls. An appendix gives data useful to a mill engineer.

The book is not simply a compilation of trade descriptions of various machines, but treats the subject from both the theoretical and practical sides and contains the results of numerous experiments aimed to improve mill efficiency. It is well illustrated and printed, and should be to definite value to mill operators as well as of students of the practice of flour milling.

W. R. J.

Farmers' Field Day

Record Gathering at Werribee

The Minister for Agriculture (The Hon. E. J. Hogan, M.L.A.), welcomes the visitors.

A RECORD gathering of farmers and graziers attended the annual farmers' field day, held at the State Research Farm, Werribee, on Friday, 25th September. Visitors, who included His Excellency the Governor (Lord Huntingfield) and the Lord Mayor of Melbourne (Cr. Wales), were welcomed by the Hon. the Minister for Agriculture (Mr. E. J. Hogan), who pointed out that the Werribee Research Farm had been provided by the State Government in order that the problems of the farming community might be investigated by a trained staff at the lowest possible cost to the community, and so that the results obtained might be tested out under practical farming conditions. The present Government recognized the importance of scientific research, and, in addition to providing new laboratory facilities at Werribee, the Government was pushing ahead with the development of the Mallee Research Station at Walpeup, while quite recently approval had been given to the expenditure of a considerable sum of money for the development of a Horticultural Research Station at Tatura.

As agriculture progressed, Mr. Hogan added, the need for research increased rather than decreased, since the intensification of farming methods gave rise to new problems that were non-existent in the days of the pioneers when extensive methods of farming prevailed, new land was being constantly broken up and, plant and animal diseases were comparatively few.

A tribute to the work of the Department of of Agriculture was paid by Lord Huntingfield, who stated that a debt of gratitude was due to past Governments and the present administration for establishing and maintaining research farms such as those at Werribee, Rutherglen, and

Scenes at the Annual Farmers'

1. *Waiting for the opening speeches;* 2. *The Minister for Agriculture (Hon. E. J. Hogan) introduces His Excellency the Governor (Lord Huntin*
Clydesdales; 6. *Mr. Bartels lecturing on irrigated pastures;* 7. *Mr. Pedrick demonstrating in the poultry section;* 8. *His Excellency*

ield Day, Werribee Research Farm. [Photos by *The Leader*.

ld) to the visitors; 3. Portion of the crowd watching a demonstration; 4. Inspecting the rotation plots; 5. Inspecting one of the farm Governor chatting with the Director of Agriculture; 9. Mr. Wilson, farm manager, explaining some commercial aspects of irrigation practices.

Walpeup, and the agricultural colleges at Dookie and Longerenong. As the State progressed further problems would arise which would require further scientific research as well as the application of practical knowledge. The farming community must aim at continual improvement which would be facilitated if the knowledge gained from the work at Werribee and other research stations were disseminated widely throughout the State.

Mr Mullett, Director of Agriculture, pointed out that, in secondary industry, research for the purpose of improving production was the private responsibility of each manufacturer, but in agriculture, with few exceptions, there was no similar commercialization of research. Instead, the State conducted the research and made the results available to all concerned, free of cost. Work at Rothamstead, the pioneer experiment station in England, had shown that agriculture could be reduced from a rule of thumb business to a science.

The illuminating discoveries made at Rothamstead had inspired the late Dr. Cameron to commence similar work in Australia and twenty years ago the Government of the day had assented to his proposal to place at the disposal of the Department of Agriculture a farm upon which the problems of the man on the land could be studied and elucidated. Subsequently, the State Farm, Rutherglen, the Mallee Research Station, Walpeup, and more recently, the Tatura Research Orchard, were established These, with Werribee and the departmental research stations at Dookie and Longerenong Colleges supplemented by 50 or so experimental plots on private farms, constituted the departmental organization for finding facts for the man on the land, and for demonstrating them to him.

Already, some spectacular results had been obtained, notably, in wheat breeding. The varieties Ghurka, Ranee 4H, and Free Gallipoli, had increased yields by an average of nearly two bushels per acre, returning an extra £800,000 a year to the wheat growers of Victoria. Eleven years ago, only two per cent of the wheat acreage of the State was sown to Werribee-bred varieties, but so great was the superiority of the new wheats that 88 per cent. of the State's acreage was now sown to them. Free Gallipoli, though a heavy yielder, having valuable agricultural qualities prized by the farmer, was viewed with disfavor by some millers and the Department was now replacing it with Ghurka, an even better yielder and superior to Free Gallipoli from a milling point of view.

The Werribee Research Farm, Mr. Mullett continued, had come into being when it had just begun to be recognized that the application of irrigation water to agricultural land beset the lay irrigator with many problems. The problem of efficient use of water and of crop suitability had since been closely studied and from that work had emerged the standard irrigation practices of today. Lucerne had proved to be a valuable crop, but unsuitable for much of the land in the Goulburn Valley. Werribee found the answer to that difficulty in irrigated pastures and visitors would see the pasture which was the forerunner of the now extensive areas of irrigated seeded pastures.

Important as had been the work of this Institution in the past and at present, it was destined to play a still greater part in the future, Mr. Mullett added. In the past, the splendid resources of the State in the shape of virgin Crown lands and irrigation water had been largely relied on to increase production but the end of these was in sight and other means would have to be exploited. This means, he believed, would be found in research, which should be organized on a basis commensurate with the important work ahead.

Young Farmers' Scholarship

For some years the Ivanhoe Grammar School has added to its curriculum theoretical and practical instruction in agricultural science, and has been most successful in passing candidates in this subject in the public examinations. To link up with the Young Farmers' Club Movement, the school is offering for 1937, a full resident scholarship of the value of £100 per annum. This scholarship is open only to members of Young Farmers' Clubs, and particulars are being sent to each club within the State. In addition to the scholastic and cultural advantage of residence in a large boarding school, the successful candidate will receive special instruction in wool-classing, agricultural chemistry, and farm mechanics, and may, if he wishes, also prepare for University Matriculation.

The scholarship may be held for all the years of the scholar's course.

Maize Trials

Results at Orbost, 1935-36

By W. J. B. McDonald, B.Agr.Sc., Inspector of Agriculture

THE results of the past season's maize variety trials are of particular significance to Orbost growers. For many years Orbost has been a maize growers' paradise in some important respects. Firstly, natural soil fertility is amazing, and shows no signs of declining, while secondly, the problem of disease had not seriously intruded itself until the summer of 1935. In regard to the latter feature, however, growers received a rather rude awakening in the past season, when the total district yield was reduced by probably 50 per cent. through an outbreak of Ear, Stalk and Root Rot disease of maize. Even under these conditions, however, some local strains of maize in the Department's trials yielded well over 90 bushels per acre.

While the seriousness of this disease intrusion cannot be discounted or minimized, it is some solace to know that the past season definitely was an extremely abnormal one. From October, 1935, to March, 1936, Orbost received 3,793 points of rain compared with a normal incidence over a 42-year period of 1,552 points.

In addition the Weather Bureau reported high daily temperatures over the State in December, with more than usually humid conditions in January. In February, temperatures were relatively low, but humidity again was high, while March was characterized by relatively high temperatures. In general, the summer months were warm and humid, with an abnormally high rainfall, the bulk of which fell in December and January.

The disease is caused by the fungus *Fusarium moniliforme* var. *Subglutinous Wr. & Rg.* (*Gibberella fugikuroi*). Symptoms of the diseases often are not apparent until the ears are fairly well developed, although infection takes place earlier. Brown rotted areas appear in the roots, and the plant often attempts to overcome the disease by sending out secondary roots from the lower nodes. As the crop matures, the leaves of affected plants begin to die and the plants lean over, individual stalks breaking off. Many growers attribute this symptom to wind damage, and overlook the rotting at the base of the stem. An examination of these stalks shows that the roots consist of little

Cob rot of maize.
[*Queens. Jnl. of Agric.*

RAINFALL FIGURES FOR ORBOST—OCTOBER, 1935, TO MARCH, 1936.

Orbost Rainfall.	October.	November.	December.	January.	February.	March.	Total.
Average for 42 years ..	299	220	272	289	231	241	1,552
Fall from October, 1935, to March, 1936	313	270	2,008	822	157	223	3,793

more than a central core, through which a pink to whitish weft of fungus threads is noticeable.

The symptoms exhibited in the cob depend on the severity of the infection. In cases of light infection the cobs apparently are normal in size, but the grain generally is pinched and of inferior quality. In severe cases, however, the cobs are light in weight, have a dry, unhealthy appearance, and are soft and easily bent. Between and over the kernels the pink to whitish weft of fungus strands may occur, extending from the silk ends towards the base of the cob. The kernels are dry, shrunken, light in weight and somewhat loose in their sockets, and may be missing largely from the silk end.

The only mechanical maize picker in Victoria.

Control Methods.

The only satisfactory method as yet evolved for the control of this disease depends largely on field sanitation and the destruction by burning of all old stalks. It is in these old stalks that the resting stage of the fungus is produced, and it is by this means that the disease carries over from season to season. This is the main source of primary infection for the succeeding crop. As soon as possible after harvest the old stalks should be raked together and burnt.

In practically every kind of agriculture, crop rotation is desirable from the point of view of maintaining soil fertility and of freeing the soil from specific disease producing organisms by interpolating a crop that does not act as a host to the particular disease under consideration. Where the one type of crop is grown on the same area of ground season after season there ultimately results a concentration of disease organisms in the area, peculiar to that particular crop. Crop rotation at Orbost, however, is limited by the liability to periodic flooding and the difficulty of finding a profitable market for alternate kinds of produce. Under these circumstances practical field sanitation becomes doubly important.

Seed selection from plants bearing the best and healthiest ears of corn is an advantage, but its importance in relation to disease control should not be overestimated. It has been shown that *Fusarium moniliforme* may be obtained in seed from apparently disease-free ears. The seed becomes infected either by direct kernel and blossom infection or by indirect seed infection through the shank.

Various discolorations at the germ end sometimes are found, and these usually are associated with infected seed. In some instances, however, heavily infected seed may appear quite normal. The fungus is carried between the seed coat layers and may extend to the aleurone layer. For this reason it is fairly obvious none of the recognized seed treatments would be satisfactory. Selection

Hickory King cobs, practically free from disease, on the property of Mr. K. Lynn.

of seed on endosperm characters, however, offers some hope of profitable results. It has been shown that in very flinty corn, the organism remains dormant for a longer period after the seed is planted than in the case of poorly filled starchy kernels. It was noticeable at Orbost last year that flinty types of maize were less affected by disease than softer varieties.

In addition it has been shown that large, dull lemon yellow-coloured ears of rough or fairly rough indentation showed a high percentage of disease, while those of a bright golden yellow, with a good depth of kernel and medium smooth indentation gave excellent results as regards viability, resistance to disease, and vigour of the root system. Remarks regarding indentation are applicable to both yellow and white maize. In the latter case pearly white are preferable to milky white ears. A pearly white maize—Hickory King—exhibited considerable immunity to disease in the plots at Orbost last year.

While it is generally considered that fertilizer treatment has no influence on the progress of the disease, it has been suggested that some types of fertilizer have a deterrent effect on its spread, and this question should be further investigated under Orbost conditions.

In last year's trials, conducted on the property of Mr. Keith Lynn, nineteen strains of maize were submitted for trial by Orbost growers. This is a very satisfactory number, but it is hoped it will be exceeded considerably in the coming season. All samples for trial should be in the hands of Mr. Keith Lynn, or Mr. W. Russell, secretary of the Maize Growers' Association, early in the month of October. The plots were sown on Snowy River frontages on the 8th October, 1935. The site had been ploughed in mid September, harrowed four times and rolled. It was ploughed again just prior to planting and again harrowed four times and rolled. At planting the soil was in excellent physical condition, but a trifle on the dry side.

By the end of the third week in April, 1936, most of the yellow varieties of maize were mature and showed some evidence of cob-rot. White varieties were later in maturing and generally promised to be heavier yielding crops. H. McLeod's Silvermine appeared to be the earliest maturing variety of white maize, while James Nixon's Manning River White was the latest.

The plots were picked at the beginning of June and stored in crates under cover until the beginning of August, when the cobs were threshed. When threshed, the grain of the various varieties contains widely differing moisture contents. The percentage of moisture in each sample of maize was determined and the yield of each plot expressed on a 14 per cent. moisture basis.

In any area of soil forming the site of an experiment, variations in fertility and productivity inevitably occur. To obtain a measure of this variation, check plots are planted at regular intervals throughout the area, their disposition being so arranged that each variety under trial is

Table Showing Yield of Orbost Maize Plots.

Maize Submitted by—	Variety.	Moisture Percentage when Picked.	Bushels Per Acre on 14 per cent. Moisture Basis.	Yield of Comparable Check at 14 per cent. Moisture.	Increase or Decrease over Check.
Reynolds Bros.	Gold-mine	19·5	96·8	87·0	+ 9·8
H. McLeod	Silvermine	19·8	80·9	71·2	+ 9·7
Irvine and Richardson	Cornplanter	21·4	97·8	89·0	+ 8·8
Keith Lynn	Hickory King	20·2	92·7	84·7	+ 8·0
James Nixon	Manning River White	23·8	71·6	65·1	+ 6·5
J. W. Lynn	Funk's Y.D. (2)	20·5	91·6	85·2	+ 6·4
J. W. Lynn	Funk's Y.D. (1)	19·5	87·4	81·9	+ 5·5
J. H. Nixon	Manning River White	22·2	85·9	82·4	+ 3·5
P. C. Nixon, jun.	Gold-mine	17·7	79·6	77·3	+ 2·3
Geo. Trewin	Yellow Dent	21·2	92·7	91·5	+ 1·2
J. Perry	Funk's Y.D.	22·8	90·5	90·0	+ 0·5
J. W. Lynn	Cornplanter	18·9	65·0	66·5	− 1·5
M. Richardson	Red Hogan	18·8	76·6	78·7	− 2·1
G. H. D. Russell	Reid's Improved	21·0	83·6	87·0	− 3·4
W. Mundy	Golden Glow (?)	18·8	62·1	68·1	− 6·0
John Lynn	Kruge Corn	17·6	51·8	62·7	− 10·9
P. H. Chow Bros.	Yellow Dent	17·5	52·4	64·9	− 12·5
Irvine and Richardson	Yellow Dent	21·0	78·1	91·0	− 12·9
M. Richardson	No. 2	17·3	48·4	68·0	− 19·6

[Continued on page 552.

Grain Crops

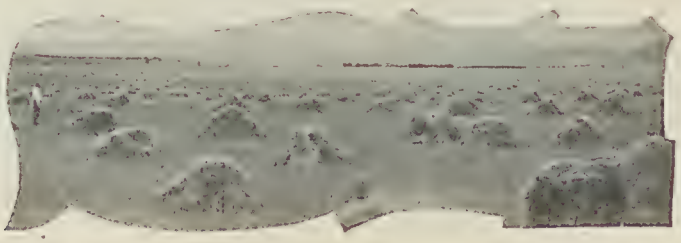
World Production and Trade

A REPORT on "Grain Crops", covering the period, 1928 to 1935, which has just been published by the Imperial Economic Committee, shows the improvement which has recently taken place in the statistical position of the wheat trade. The encouragement given to agriculture, especially to wheat growing, in various European countries, together with the increased restrictions on imports, greatly reduced the demand for overseas grain and led to the accumulation of large stocks; this situation has altered materially in the past year and now, thanks to reduced acreage and drought, it appears probable that the world carry over on 1st August next will be less than 17 million tons. In 1934 the carry over exceeded 31 million tons. Expectation of the gradual liquidation of these large supplies led, during 1935, to an advance in price to the highest level reached since 1930.

The report is mainly a statistical analysis of the world production of and trade in wheat, barley, oats, maize and rice during the past eight years. It shows that the 1934 area and production of each of these five crops was lower than the average for 1928–1933, and that the Empire's share of the total stands at about 23 per cent., though for rice alone 56 per cent. of the world production is grown within the Empire. The most notable change during this period is the increased production of wheat, barley and oats in the U.S.S.R., which has recently replaced the United States as the world's largest producer of these three commodities. Within the Empire, Canada was formerly the largest producer of wheat and barley, but India now leads in these crops as well as in maize and rice.

International trade in these cereals and in wheat flour fell generally during this period, with the United States the chief sufferer. Exports of these six products from the United States amounted to 5,646,000 tons in 1928 but, after a steady decline, to only 547,000 tons in 1935. Canadian exports, which at 11,759,000 tons were abnormally large in 1928, fell to 5,251,000 tons in 1935. From Australia exports have fallen since 1931, but have remained above the level of 1928–1930. The statistics of the importing countries show the other side of the picture: Imports of these six commodities into France, Belgium, Netherlands, Germany, Switzerland, and Italy, fell from 17,479,000 tons in 1928 to 8,861,000 tons in 1935. A section of the report is devoted to an exposition of the forms of import restriction imposed and the duties levied by these six countries, which have contributed substantially to the shrinkage of the European market.

A feature of the report is the calculation of the Empire's net position with regard to the trade in each of these products. The Empire has for sale to foreign countries a considerable surplus of wheat and flour which frequently amounts, in the case of wheat alone, to more than two million tons. India normally has a surplus of rice sufficient to meet the import requirements of the other parts of the British Commonwealth, but for the secondary cereals it is necessary for the Empire to have recourse to foreign sources of supply. The report is probably not on sale in Melbourne, but copies can be obtained through any Melbourne bookseller, or else direct from the Secretary, Imperial Economic Committee, 2 Queen Anne's Gate Buildings, Dartmouth-street, London, S.W.1. Its price in London is 2s. 6d., to which sum exchange would have to be added.



Vaccination of Sheep

Technique Adopted

By R. N. Wardle, B.V.Sc., Veterinary Officer.

INSTRUCTIONS for the vaccination of sheep against Black Disease, and of sheep or lambs against Entero-toxaemia (Pulpy Kidney) are set out in the following article.

Vaccination should be carried out in the shearing shed, the floor of which must be swept clean. The only exception to this is made in the case of young lambs being given the first dose of vaccine against entero-toxaemia at the time they are marked. In such cases it is advised that extra precautions be taken against dust and flies, and further, the person doing the vaccinating should do nothing else.

Materials.

A small table, large box, or 40-gallon petrol drum, on which to set out the instruments, &c., is placed in a convenient position close to the catching pens, and should be nailed to the floor or tied securely. Where there are two catching pens with a space between the doors, this space is the most convenient place for the table. Greater speed can be attained with the table in this position, as one step will bring the operator to the sheep brought out from either pen.

Two glass jars each of about 10-oz. capacity with screw-on lids; three 2-oz. wide-mouthed bottles; one small flat dish; a 10 c.c. glass-barrelled syringe and spare barrel; three push-on needles, No. 18 gauge; pair small pliers; scissors, rubber gloves (household variety); roll of cotton-wool; 5 oz. tincture of iodine per 1,000 sheep, and a small bottle each of methylated spirit and of formalin, are required. An aluminium saucepan should be kept solely for the purpose of sterilizing the syringe and vaccine jar. It is desirable that all the apparatus be kept together in a box when not in use: for this purpose nothing is better than a fibre attache case, the cost of which is very small.

Sterilization of Syringe and Vaccine Jar.—The syringe should be sterilized by boiling for ten minutes: the piston is removed from the barrel and the two parts are placed in a saucepan of clean, cold, or lukewarm water which is then boiled for ten minutes, at least.

The syringe case is swabbed out with methylated spirit and the syringe lifted from the boiling water and placed in the case. The needles need not be boiled, but should be placed in spirit in the flat glass dish.

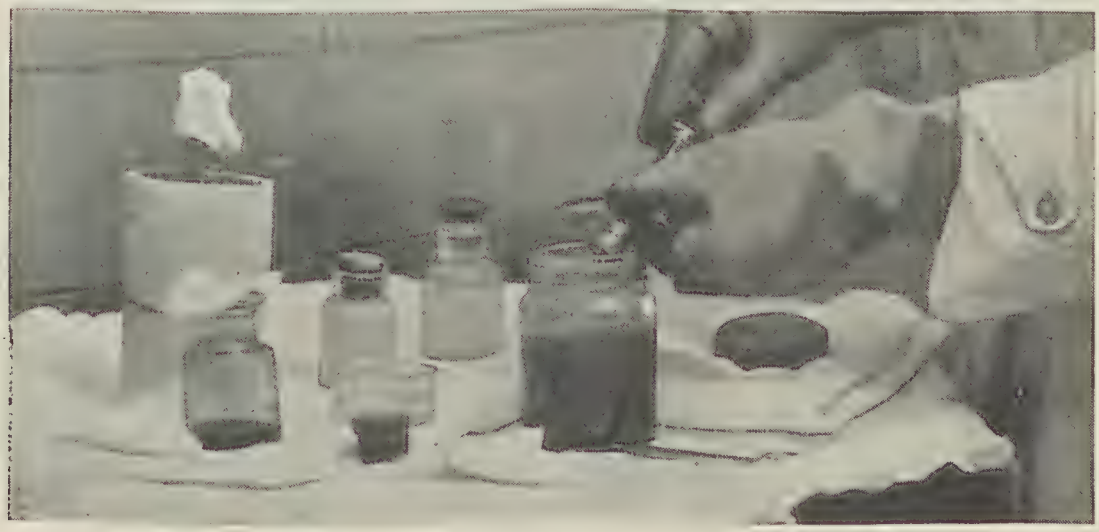


Fig. 1.—Apparatus required for sheep vaccination set out ready for use.

The vaccine jar and lid also should be boiled for ten minutes, and then wrapped in a sheet of note paper. This work may be done conveniently the evening before use.

Preparation.

The table is covered with the packing cotton-wool in which the larger vaccine containers are wrapped, or failing this, with a clean cloth or towel. The three 2-oz. bottles are used for tincture of iodine, methylated spirit, and formalin, and the small flat dish is used to hold the needles which are covered with methylated spirit. In this way the needles are kept sterile, and the spare ones are available should the one in use need replacing.

Several small cotton-wool swabs about two inches square are cut, together with a single piece twelve inches by eight inches. The latter is folded to make a cover eight inches by six inches, between the fold of which the assembled syringe is placed whenever not actually in the hand. This wool also makes a suitable place on which to put the vaccine jar lid during filling of the syringe. Figure 1 shows the apparatus set out on the top of a petrol drum.

The operator now slips on the rubber gloves, which will go on quite easily if the inside of the gloves and the back of the hands are dusted with French chalk or talcum powder. The gloves are then swabbed over with spirit, which dries quickly: formalin would also sterilize the gloves, but leaves them slippery for some little time.

The syringe is assembled and a needle tightened on with the pliers, the jaws of which have been swabbed with methylated spirit. The vaccine container is shaken: the stopper eased slightly, and the top of the tin and stopper swabbed with formalin. The vaccine jar is filled (if doing large numbers of sheep the use of two jars will expedite the work). While filling the jar, the rubber stopper from the vaccine container should be placed on a small cotton-wool swab soaked in formalin, and the stopper after being replaced in the container should be covered by this same swab to prevent contamination by dust or flies.

Care is needed in pouring the vaccine from a metal container. The can should be held with

Fig. 2.—Showing sheep held correctly for thigh inoculation.

Fig. 3.—Showing shorn sheep held in position for fore-leg vaccination.

the opening uppermost, and the lip of the receptacle placed under the nozzle of the tin: the air in the top of the tin aids the slow pouring of the vaccine. If an attempt is made to pour from the full container in the usual manner, the vaccine will come out with force and be spilled.

Instructions to Catchers.

A few words to the men on the necessity for the operator to keep instruments and vaccine free from contamination is timely: the object being that the operator should refrain from touching any part of the sheep with his hands, and the men should avoid handling anything on the table.

For Thigh Inoculation.

Two catchers are used for each pen, and with four sheep out on the board, instructions in the method of holding are important. The catchers turn the sheep over in the pen, and walking out backwards swing the sheep slightly towards the operator: the first catcher from each pen places his sheep over near the chute while the No. 2 catchers draw up alongside and slightly behind. The operator coming over to the right as he turns round inoculates in the left thigh of the sheep on his right, and in the right thigh of those on his left.

The front leg of the side in which the inoculation takes place is held with the hand furthest from the operator: i.e., two catchers hold the left front leg with the right hand, and the other two hold the right front leg with the left hand. The other hand is then brought down with the thumb held close to the fingers, and placed just above the stifle joint; at the same time holding away the fringe of wool present along the flank. There should be no tension on the skin of the thigh.

The head of the sheep must be kept up, and the animal should be sitting evenly on its rump, leaning back sufficiently to expose a maximum amount of the bare skin of the inner aspect of the thigh. See Fig. 2. Kicking rarely takes place if the sheep is placed evenly with head up: should it draw its leg up or kick, the catcher's hand is in position to press above the stifle to straighten and hold the leg. With sheep held in this way, the operator has a chance to choose a clean area in which to inoculate, and with the flank fold of skin and its fringe of wool held away, the syringe does not come in contact with any part of the sheep. As soon as the dose of vaccine is injected a forward thrust from the catcher, heads the sheep straight for the chute opening.

A warning should be issued to the men against the tendency, with some, to spread out the thumb and place it along the junction of the thigh and the abdomen: when this is done, the thumb comes in the way of the needle, and in endeavouring to avoid pricking the catcher, time is lost.

For Arm Inoculation.

If the operator prefers to inoculate inside the arm instead of inside the thigh, the sheep are brought out on to the floor in the same manner, being held by the front legs. In sheep with little wool, sufficient bare skin is exposed to allow the inoculation to be carried out without extra assistance from the catcher, but with sheep in the wool the catcher uses one hand to hold away any fringe of wool in order to expose a good field for the operation. Fig. 3 shows a fore-leg inoculation position. For the purpose of the photograph the operator had to stand more to the side than he would in actual practice.

Inoculation.

Before beginning to inoculate, the operator should make himself familiar with the divisions marked on the barrel of the syringe so that he

will know just how far to press the piston to inject either 2 c.c. or 5 c.c. doses.

After the syringe is filled, the lid should be replaced on the jar to prevent contamination by flies and dust: a swab well-soaked in iodine is dabbed on the bare skin forcibly, and the needle is introduced just through the skin. The object is to inject the dose under the skin and to avoid placing it in the deeper tissues. With a little practice it will be found that it is unnecessary to hold the skin while introducing the needle, and as the needle penetrates the skin the piston is pressed by the thumb until the dose of vaccine is injected. Fig. 4 shows the needle entering the thin skin of the thigh, and the thumb ready to press on the piston, while Fig. 5 shows the needle entering the skin under the arm: the operator's hand being lowered to allow this to be seen.

While moving back to the table to refill the syringe, the needle should be wiped through a channel of the iodine swab formed by turning over the corner nearest the palm of the hand: this part of the swab does not come in contact with the skin of the sheep. While the operator is refilling the syringe, the catchers should have fresh sheep out on the floor ready to be inoculated.

Fig. 4.—Inoculation of sheep at inner aspect of thigh.

Fig. 5.—Inoculation under the arm.

Use of Antiseptics.

Methylated spirit and formalin are used for antiseptic purposes. At each recess, about 2 c.cs. of formalin should be drawn up into the syringe to rinse it: this is discarded, then another small quantity drawn-up and left in the syringe. The outside should be swabbed over with spirit and the syringe placed under the fold of cotton-wool kept for that purpose. Before being used again, the formalin in the syringe is ejected.

At intervals, during the work, the rubber gloves should be swabbed over with spirit. Should a needle loosen and fall off the syringe, it will be found advantageous to take a fresh one from the spirit to avoid delay. During a recess the soiled needle can be cleaned and placed in the dish of spirit.

Care of Vaccine.

The vaccine against either black disease or entero-toxaemia in unopened containers should be stored in a cool dark place until required for use.

Vaccine should be ordered in quantities that will allow the contents of a container to be used in any one day. Any residue in the container should not be stored away for future use after the tin or bottle has been opened.

Butter Production and Export

The following tables show:—

(*a*) Factory production of butter and cheese in Victoria for the period July, 1935, to June, 1936, compared with the corresponding periods of 1934–35; and

(*b*) Quantities and percentages of various grades of bulk butter examined in Victoria from 1st July to 29th August, 1936, in comparison with the corresponding period of 1935.

FACTORY PRODUCTION OF BUTTER AND CHEESE IN VICTORIA (QUANTITIES IN TONS).

Month.	Butter.		Cheese.	
	1935–36.	1934–35.	1935–36.	1934–35.
July	3,039	2,436	285	153
August	4,365	3,673	367	250
September	6,159	5,545	504	424
October	9,309	7,394	689	567
November	10,136	8,996	681	588
December	8,476	8,761	579	515
January	6,670	7,270	483	434
February	4,613	5,106	334	352
March	3,589	4,401	263	307
April	2,853	3,933	226	320
May	2,406	3,414	204	314
June	2,148	2,939	208	290
Totals, 12 months	63,763	63,868	4,823	4,514

BULK BUTTER EXAMINED FOR EXPORT IN VICTORIA (QUANTITIES IN TONS).

Period.	1936–37. How Graded—				Total.	Period.	1935–36. How Graded—				Total.
	Ch.	1st.	2nd.	Pty.			Ch.	1st.	2nd.	Pty.	
1st July to 25th July	30	9	15	2	56	1st July to 27th July	576	178	55	5	814
26th July to 29th August	757	305	91	15	1,168	28th July to 31st August ..	1,187	433	115	11	1,746
Totals 1st July to 29th August ..	787	314	106	17	1,224	Totals 1st July to 31st August ..	1,763	611	170	16	2,560
Percentages ..	64·3	25·6	8·7	1·4	..	Percentages ..	68·9	23·9	6·6	0·6	..

Apple Washing Trials

Tests in 1934 and 1935

By A. G. Strickland, M.Agr.Sc., and C. E. Cole,† B.Agr.Sc.*

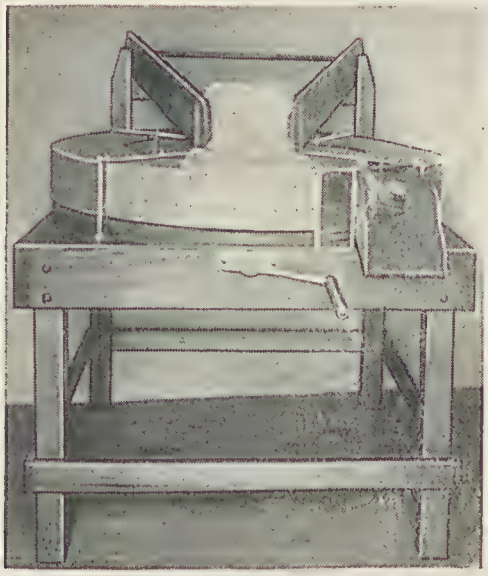
SINCE Health authorities in the United Kingdom, various States of Australia, and elsewhere have insisted upon fruit being marketed free from arsenical residue in excess of a tolerance of 0.01 grains of arsenic trioxide per pound of fruit, it has become necessary for growers to reduce by some means the amount of spray residue on pome fruits destined for overseas and interstate markets. Spray programmes evolved by the Department of Agriculture have been shown to enable the production of fruit comparitively free from arsenical residue but, pending the general adoption of these spray programmes, treatment after picking will still be necessary, particularly with early and mid-season varieties. The Department always has recommended that the fruit be washed rather than wiped, and much work has been done investigating the problems which confront the orchardist in so treating his fruit. A detailed account of the experiments carried out in the course of these investigations during 1934 and 1935 is given in the following pages.

The experiments have been concerned almost solely with washing in troughs, or hand-washing, mainly because the present organization of the pome fruit industry is such as to preclude the general use of machines. Those at present on the market are large and expensive, and may be operated economically only by very large individual growers, packing sheds, or co-operative organizations. The majority of growers are compelled, therefore, to use the relatively tedious method of hand-washing their export fruit. Attention has been confined in the trials to the washing of apples, as they are the major export crop, and present difficulties, such as core penetration by washing solutions, which are not encountered in the washing of pears.

Before it can come into general use a washing medium should be capable of reducing any type of arsenical residue to such an amount that the quantity of arsenic remaining on the fruit, after treatment, is below the tolerance. Secondly, it should not affect in any deleterious manner the appearance or subsequent behaviour of the fruit, while thirdly, the cost of the material and mode of application should not be such as to increase costs of production unduly. As yet, no ideal washing agent has been discovered, but two materials are outstandingly superior to the many other substances which have been tried—namely hydrochloric acid and sodium silicate. They are to some extent competitive, but far more complementary in their action, in that the one is more effective in the removal of certain types of residue than the other, and vice versa. Various auxiliary substances may be added in small quantities to either of these agents to ameliorate its action.

A crude method of removing residues, consisting of a sheep-skin fitted over the elevator of a sorting table.

* Formerly a Horticultural Research Officer of the Victorian Department of Agriculture.
† Assistant Horticultural Research Officer.



A rotary sheep-skin dry-cleaning machine.

1934 Tests.

Earlier trials (1) had shown that hydrochloric acid in 1½ and 3 per cent. solutions [see footnote*] was an effective and safe agent for the removal of arsenical residues under normal conditions. In practice, however, it was found that some residues resisted the action of the acid, and were not reduced below the tolerance. The 1934 trials, conducted at Blackburn, were directed therefore, firstly to a comparison of the effectiveness of hydrochloric acid with that of sodium silicate, particularly with regard to the removal of oily residues; and secondly to a study of the effects of the various treatments on the storage life of the fruit.

Apples of the varieties Jonathan and Delicious were obtained from codling moth experimental plots conducted by the Department, and the spray history of the fruit was known accurately. The fruit was treated in case lots, each lot being transferred for washing purposes to a long bushel case in order to avoid too deep submersion. The actual washing was done in an 80-gallon cask sawn in half, one half being used for the chemical wash and the other for the rinse bath. A slow stream of clean water was allowed to flow continuously into the rinse bath, which was thus kept quite fresh.

Random samples of twenty apples were taken from each line of fruit before washing, and a further random sample of the same number was taken after each washing treatment. These samples were packed between sheets of paper in dump cases and submitted to the Agricultural Research Chemist for analysis, which at that time was done by the Association of Official Agricultural Chemists' or "long" method of peeling the fruit, digesting the peel with acid to remove organic matter, and estimating the arsenic in the residue.

Variety and Spray Schedule.

Following are the varieties and spray treatments used during the 1934 tests.

Jonathan, grown at Tyabb, sprayed with arsenate of lead only.

Jonathan, grown at Tyabb, sprayed four times with lead arsenate and once with white oil.

Jonathan, grown at Tyabb, sprayed three times with lead arsenate and twice with white oil.

Jonathan, grown at Blackburn, sprayed four times with lead arsenate alone, once with lead arsenate plus white oil, and once with white oil alone.

Delicious, grown at Blackburn, sprayed with lead arsenate only.

Delicious, grown at Blackburn, sprayed with lead arsenate twice and white oil four times.

Delicious, grown at Blackburn, sprayed twice with lead arsenate, then with white oil, then with lead arsenate, then with white oil, and lastly with lead arsenate.

Sprays had been applied according to the incidence of codling moth broods in each locality.

A straight four-channel sheep-skin wiping machine.

* For convenience, the strength of hydrochloric acid is expressed as percentage of commercial acid (S.G. 1·2) present—e.g. 3 per cent. acid means 3 gallons of commercial acid per 100 gallons of solution, equivalent to 1 per cent. actual acid.

TABLE I.—GRAINS OF ARSENIC TRIOXIDE (As_2O_3) PER POUND OF FRUIT.—1934 TESTS.

Variety and Spray Treatment.	Unwashed.	Washed in—			
		Two per cent. Hydrochloric Acid for Two Minutes.	Three per cent. Hydrochloric Acid for Two Minutes.	Three per cent. Hydrochloric Acid + Two per cent. Common Salt for Two Minutes.	Eight per cent. Sodium Silicate for Two Minutes.
Jonathan—Lead arsenate only	0·053	0·0042	..	..	0·0063
Jonathan—Lead arsenate four times; white oil once ..	0·022	..	..	0·0040	0·014
Jonathan—Lead arsenate three times; white oil twice ..	0·013	0·0029	0·0028	0·0030	0·0088
Jonathan—Lead arsenate alone four times; lead arsenate and white oil once; and white oil alone once ..	0·059	..	0·015	0·014	0·039
Delicious—Lead arsenate only	0·085	0·014	0·0051	..	0·036
Delicious—Lead arsenate twice; white oil four times ..	0·012	..	..	..	..
Delicious—Lead arsenate twice; then white oil, then lead arsenate, then white oil, and lastly lead arsenate ..	0·026	0·0095	0·0090	0·0073	0·019

WASHING TREATMENTS.

The following washing treatments were given also:—

Unwashed.

Washed in 2 per cent. hydrochloric acid for two minutes.

Washed in 3 per cent. hydrochloric acid for two minutes.

Washed in 3 per cent. hydrochloric acid plus 2 per cent. common salt for two minutes.

Washed in 8 per cent. (80 lb. per 100 galls.) sodium silicate for two minutes.

The hydrochloric acid used was the commercial grade, specific gravity 1.2 and containing 33 per cent. actual acid. The sodium silicate was the

A brush type of dry-cleaning machine.

TABLE II.—STORAGE BEHAVIOUR OF WASHED APPLES—FIGURES OF THE FINAL COUNT EXPRESSED AS PERCENTAGES.—1934 TESTS.

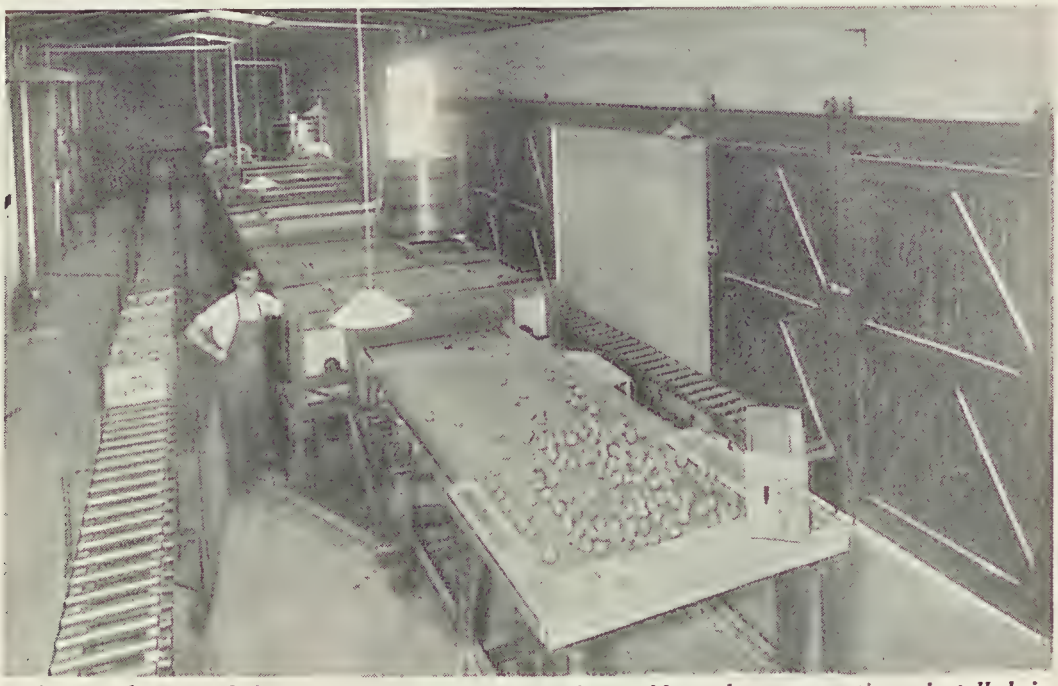
(a) Jonathan Apples.

Treatment.			Sound.	Jonathan Spot.	Breakdown.	Mould.
			%	%	%	%
Jonathan—Sprayed with lead arsenate only.	Unwashed		84·9	7·5*	0·0	7·5
	Washed in—	Two per cent. hydrochloric acid for two minutes	82·2	5·5*	0·0	12·3
		Three per cent. hydrochloric acid for two minutes	90·2	4·7*	0·9	4·2
		Three per cent. hydrochloric acid + two per cent. common salt for two minutes	93·6	0·9	1·8	3·7
		Eight per cent. (80 lb. to 100 gall.) sodium silicate for two minutes	94·4	0·0	0·0	5·6
Jonathan—Sprayed with lead arsenate four times and white oil once.	Unwashed		95·9	3·3	0·0	0·8
	Washed in—	Three per cent. hydrochloric acid + two per cent. common salt for two minutes	93·3	2·5	1·7	2·5
		Eight per cent. (80 lb. to 100 gall.) sodium silicate for two minutes	92·0	0·7	0·0	3·3
Jonathan—Sprayed with lead arsenate three times and white oil twice.	Unwashed		87·5	7·1	0·5	4·9
	Washed in—	Two per cent. hydrochloric acid for two minutes	87·0	9·9†	3·0	0·0
		Three per cent. hydrochloric acid for two minutes	73·9	22·4†	0·0	3·7
		Three per cent. hydrochloric acid + two per cent. common salt for two minutes	86·0	12·2†	0·9	0·9
		Eight per cent. (80 lb. to 100 gall.) sodium silicate for two minutes	88·4	7·1	0·5	4·0

* Slight. † Severe.

(b) Delicious Apples.

Treatment.			Bitter Pit only.	Bitter Pit and Skin Burn.	Skin Burn only.	Scald.	Break-down.	Mould.
			%	%	%	%	%	%
Delicious—Sprayed with lead arsenate only.	Unwashed		15·8	39·5	32·6	1·1	6·3	4·7
	Washed in—	Two per cent. hydrochloric acid for two minutes	23·8	37·1	25·1	0·0	8·4	5·6
		Three per cent. hydrochloric acid for two minutes	40·6	24·5	23·3	1·3	6·4	3·9
		Eight per cent. (80 lb. to 100 gall.) sodium silicate for two minutes	19·9	40·4	34·7	0·7	0·0	4.3
Delicious—Lead arsenate twice; then white oil, then lead arsenate, then white oil, and lastly lead arsenate—Unwashed			88·8	0·0	0·0	0·0	4·1	7·1



A fruit packing machine—said to be the largest in the world at the present time—installed in a Shepparton packing shed.

"water-glass" of commerce, S.G. 1.7, having the following composition :—

Sodium oxide (Na_2O)	..	16.4 per cent.,
Silica (SiO_2)	.. ..	35.7 per cent., and
Water (H_2O)	..	45.1 per cent.,

with a $Na_2O : SiO_2$ ratio of 1 : 2.17.

The results of analyses made on samples of the unwashed and washed fruit are given in Table I.

Residue Removal.

The figures contained in this table indicate that for Jonathans subjected to a straight arsenical spray schedule, 2 per cent. acid was sufficient to reduce the arsenic below the tolerance. The inclusion of a combined lead arsenate and mineral oil spray in the schedule rendered any of the treatments ineffective. Delicious apples, a more waxy type than Jonathan, required 3 per cent. acid for successful washing treatment. The addition of 2 per cent. of common salt to 3 per cent. hydrochloric acid did not increase its efficiency significantly. Sodium silicate under the conditions of the experiment was not so effective in the removal of residue as was the acid, and was only sufficiently effective on non-waxy apples sprayed with lead arsenate only.

Storage Behaviour of Washed Fruit.

After being washed and sampled, certain of the fruit was transported to a cool chamber and held at a temperature of 34° F. for several months, during which time it was kept under regular observation. The results of the final count, made in January, 1935, are recorded in Tables II. (*a*) and II. (*b*).

The figures for Jonathan spot, bitter pit, and skin burn will not be discussed in this paper, as there is nothing to suggest that the occurrence of these disorders is connected with the washing treatment given to the fruit concerned. They are included here solely for the purpose of placing them on record.

The important feature of these tables is the lack of any disorder which could be attributed to the washing treatment employed. Even mould, which sometimes may be rendered more troublesome as a result of washing, showed no significant constant increase in the washed fruit above that in the unwashed fruit. No increase of mould would be expected when washing such a comparatively small number of cases, this trouble usually being associated with undue concentration of mould spores in wash water, after the treatment of large numbers of cases without replacement of the washing solution.

From these experiments it was concluded that, under typical Victorian conditions, hydrochloric acid was superior to sodium silicate as a washing agent, because it gave better residue removal and in no way affected the subsequent behaviour of the fruit. The 1935 experiments were based on this conclusion.

A type of washing trough in common use, but not of the most convenient design.

1935 Tests.

The main purpose of the first set of trials in 1935 to was investigate various methods of using hydrochloric acid for the hand-washing of fruit; however, the washed fruit was again stored, and kept under observation for some months in view of additional varieties and different conditions from those of the previous trials.

Apples of known spray history were obtained from dependable growers as soon after picking as possible. A composite sample was taken in duplicate from each line of fruit. Each sample consisted of the ten fruits apparently representative of the heaviest residue. This procedure was recommended by the Victorian Advisory Committee on Plot Technique, because of the prevailing methods of examining export fruit, and also because it would put each washing treatment to the severest test possible.

After sampling, the fruit was washed in dump cases, the boards of such cases set well apart to permit free movement of the solutions, rinsed, sampled again in the manner described above, and removed to cool store. The air temperature on the day of washing (21.3.35) was 62.6° F., the temperature of the acid bath was 63.5° F., and that of the rinse bath 64.4° F. Each trough contained 50 gallons of liquid, in which each dump case was fully submerged, giving a maximum depth of submersion, for any apple, of about 15 inches. This was done to demonstrate any susceptibility of the varieties used to acid penetration rot when deeply submerged.

Variety and Spray History.

The varieties, spray history, and washing treatments used in the 1935 trials, are as follow:—

Jonathan, sprayed with lead arsenate only.

Jonathan, sprayed with lead arsenate and one white oil spray.

Delicious, sprayed with lead arsenate only.

Five Crown, sprayed with lead arsenate only.

Granny Smith, sprayed with lead arsenate only.

Washing Treatments.

Unwashed.

Washed in 1 per cent. hydrochloric acid for two minutes.

Washed in 1 per cent. hydrochloric acid for four minutes.

Washed in 3 per cent. hydrochloric acid for two minutes.

Washed in 3 per cent. hydrochloric acid for four minutes.

Table III.—Arsenic Trioxide in Grains Per Pound of Fruit—1935 Tests.

Variety and Spray Treatment.	Unwashed.	Washed in Hydrochloric Acid.			
		One per cent.		Three per cent.	
		Two Minutes.	Four Minutes.	Two Minutes.	Four Minutes.
	%	%	%	%	%
Jonathan—Lead arsenate only	0·070	0·013	0·0072	0·0055	0·0033
Jonathan—Lead arsenate and one white oil	0·121	..	..	0·035	0·020
Delicious—Lead arsenate only	0·120	..	0·011	0·0076	..
Five Crown—Lead arsenate only	0·066	..	..	..	0·0070
Granny Smith—Lead arsenate only	0·055	..	..	0·012	0·0054

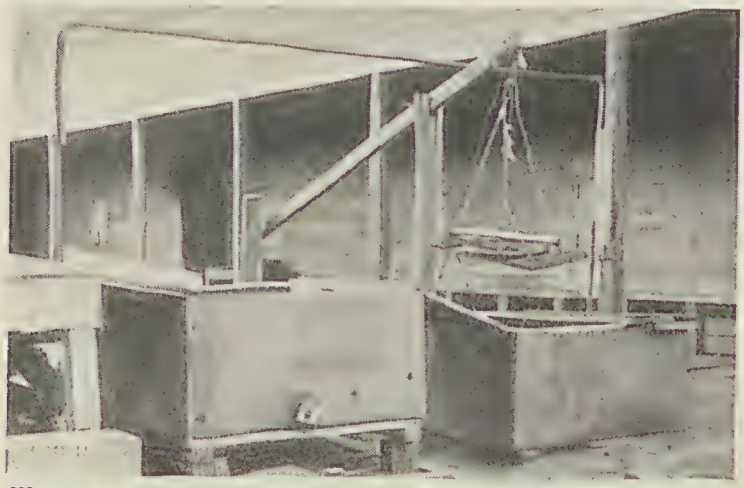
The Jonathan apples were ungraded and slightly immature, and were subject to slight shrivelling after a few months in store. The Delicious apples were very large, having been grown under irrigation, and heavily coated with residue. The Five Crown and Granny Smith apples were quite typical of the varieties.

Residue Removal.

The analyses of samples taken from this set of experiments were done by the "short" method of immersing the whole fruit in hot acid or caustic solution, according to the nature of the residue, then determining the arsenic in the liquor. The results of these analyses are recorded in Table III.

The residue on Jonathan apples, a comparatively non-waxy variety, sprayed with lead arsenate alone, was reduced sufficiently by immersion in 1 per cent. acid for four minutes, and more effectively by immersion in 3 per cent. acid for two minutes. When, however, an oil spray had been applied to the fruit, the final residue was heavier, and it was not removed sufficiently even by the most severe treatment, namely, immersion in 3 per cent. acid for four minutes. This difficulty of removing residues containing mineral oil sprays is one of the major problems in fruit washing, and requires further investigation.

The residue on Delicious apples, a rather waxy variety compared with Jonathan, was reduced sufficiently by immersion in 3 per cent. acid for two minutes, but not by immersion in 1 per cent. acid for four minutes. Five Crown apples, also fairly waxy, required a 3 per cent. acid solution for efficient washing. The Granny Smith variety, which at times becomes very greasy, required immersion in 3 per cent. acid for four minutes to be washed sufficiently free of residue. In general oily residues and residues on waxy varieties required stronger acid solutions and longer periods of immersion for their removal than did ordinary lead arsenate residues on non-waxy apples.



Washing troughs made from cutting in half a 400-gallon iron tank. The acid trough is cemented internally, and fitted with a special cradle for dipping the fruit.

Storage Behaviour of the Fruit.

Periodical examinations were made of the fruit in store, and unsound fruit removed from each case during each examination. Table IV. shows the storage results after 23 weeks at 34° F.

Mould.

No acid or arsenical injury to calyx or skin was observed in any of the fruit. In the case of Jonathan and Five Crown apples the immersion of the fruit appears to have increased mould losses above those incurred by unwashed fruit. The Jonathan apples sprayed with lead arsenate only, and with lead arsenate and one oil spray, cannot be directly compared in so far as mould is concerned owing to the fact that they were obtained from different orchards—i.e., it cannot be assumed that the inclusion of an oil spray in the programme was responsible for reduction of mould. No explanation can be offered at this stage for the low level of mould in the series "Jonathans sprayed with lead arsenate only and washed with 3 per cent. hydrochloric acid for four minutes."

The Delicious apples showed remarkably little external mould, and those washed in 1 per cent. hydrochloric acid for four minutes remained in store for practically six months without developing any at all. No increase was caused by the dipping of the fruit. The exceptionally high figure for external mould on the unwashed Granny Smith apples was due to the extensive occurrence of a target-spot fungus of the Glæosporium type, which was fairly common in stored fruit during 1935. The incidence of this disorder in the washed fruit was about half of that in the unwashed fruit.

Core Rot.

The chief interest of Table IV. lies in the figures for core rot. This disorder was practically confined to varieties with wide open calyces, and apparently followed the penetration of acid into the core. Jonathan apples showed only a small proportion of such core rot, and only where the stronger 3 per cent. acid was used. Delicious apples showed an increase from nil in the unwashed fruit to 77.8 per cent. where they were immersed in 3 per cent. acid for two minutes. Five Crown apples, of which 1.7 per cent. developed core rot when unwashed, developed 24.8 per cent. after immersion in 3 per cent. acid for four minutes. No core rot developed in Granny Smith apples.

Examination of affected apples showed that the rot was due to the fungus *Penicillium expansum*. There was very little evidence of actual acid injury of the core, and the chief action of the acid seemed to be in providing favorable conditions for mould growth, causing it to penetrate the flesh of the apples very readily. Such stimulation of the growth of certain mould species by a high hydrogen ion concentration has been demonstrated by several investigators, and was apparently of importance in this instance. The growth of the mould caused the flesh to become transparent and rather watery, and produced large gas cavities therein. Apples often appeared quite normal externally, but the rot was readily detected by the application of pressure to the fruit.

At the end of the storage period the surviving fruits in each case were cut longitudinally, and records made of the nature of the calyx tube of

Table IV.—Percentages of Sound and Unsound Fruit After 23 Weeks Storage at 34° F.—1935 Tests.

Treatment.			Sound.	Core Rot.	External Mould.
			%	%	%
Jonathan—Sprayed with lead arsenate only.	Unwashed		80·6	..	19·4
	Washed in hydrochloric acid.	One per cent. for two minutes	72·8	..	27·2
		One per cent. for four minutes	73·8	..	26·2
		Three per cent. for two minutes	71·4	0·9	27·7
		Three per cent. for four minutes	83·6	1·2	15·2
Jonathan—Sprayed with lead arsenate and one white oil spray.	Unwashed		97·5	..	2·5
	Washed in hydrochloric acid.	Three per cent. for two minutes	94·3	0·6	5·1
		Three per cent. for four minutes	90·0	2·2	8·2
Delicious—Sprayed with lead arsenate only.	Unwashed		97·8	..	2·2
	Washed in hydrochloric acid.	One per cent. for four minutes	94·4	5·6	..
		Three per cent. for two minutes	19·7	77·8	2·5
Five Crown—Sprayed with lead arsenate only.	Unwashed		73·1	1·7	25·2
	Washed in three per cent. hydrochloric acid for four minutes		42·6	24·8	32·6
Granny Smith—Sprayed with lead arsenate only.	Unwashed		58·5	..	41·5
	Washed in hydrochloric acid.	Three per cent. for two minutes	79·7	[1·3 frozen]	19·0
		Three per cent. for four minutes	79·5	..	20·5

each apple. Although it was often difficult to determine whether the tube was open or closed, the final figures are recorded in Table V. in order to demonstrate their relation to core rot.

The highest percentage of open calyces occurred in the Delicious variety, which also developed the highest percentage of core rot. The significance of the decreased percentages in the washed fruit is obvious, the rejection of fruits with core rot having eliminated many of the open calyx tube apples—i.e., there was a distinct relation between the state of the calyx tube and the amount of core rot developed after washing.

A similar difference existed in the Five Crown apples, although the proportion of open tubes

TABLE V.—PERCENTAGES OF OPEN CALYX TUBES IN UNWASHED AND WASHED APPLES AFTER STORAGE AND ELIMINATION OF APPLES DEVELOPING CORE ROT AND EXTERNAL MOULD.—1935 TESTS.

Variety and Treatment.			Percentage of Open Calyx Tubes.
Jonathan—Sprayed with lead arsenate only.	Unwashed		38·0
	Washed in hydrochloric acid.	One per cent. for two minutes	38·5
		One per cent. for four minutes	35·0
		Three per cent. for two minutes	37·0
Jonathan—Sprayed with lead arsenate and one white oil spray—Unwashed ..			41·0
Delicious—Sprayed with lead arsenate only.	Unwashed		91·5
	Washed in hydrochloric acid.	One per cent. for four minutes	88·5
		Three per cent. for two minutes	30·2
Five Crown—Lead arsenate only.	Unwashed		42·5
	Washed in three per cent. hydrochloric acid for four minutes ..		23·5
Granny Smith—Lead arsenate only.	Unwashed		1·2
	Washed in hydrochloric acid.	Three per cent. for two minutes	1·0
		Three per cent. for four minutes	0·0

was lower than that in the Delicious apples. In the Jonathan apples, averaging 37 per cent. of open calyx tubes, only a very low percentage of core rot developed. This varietal difference was attributable to variation in the diameters of the calyx tubes. In the Delicious and Five Crown varieties the tube frequently reached a diameter of one-eighth of an inch at its narrowest point, whereas in the Jonathan no tube of greater diameter than one-sixteenth of an inch was observed. Apparently the acid was unable to penetrate such a narrow tube. Apples of the Granny Smith variety almost invariably had no calyx tube, consequently no core rot could develop. A more accurate method of determining the state of the calyx tube in apple varieties is being developed.

The second set of trials in 1935 was undertaken as soon as core rot in the fruit of the first set became serious, and were directed towards finding means of preventing or reducing the occurrence of core rot in open calyx varieties of apple.

Five Crown apples of the same line as those used in the first set of trials were taken from cool store, allowed to warm up to air temperature, and after culling of mouldy fruit, subjected to the following treatments :—

1. Unwashed.
2. Washed in 3 per cent. hydrochloric acid for four minutes, submerged no deeper than 6 inches, rinsed in water.
3. Washed in 3 per cent. hydrochloric acid for four minutes 12 inches below the surface, and rinsed in water.
4. Washed in 3 per cent. hydrochloric acid for four minutes submerged no deeper than 6 inches, rinsed in lime water and douched with fresh water.
5. Washed in 3 per cent. hydrochloric acid for four minutes 12 inches below the surface, rinsed in lime water and douched with fresh water.
6. Washed in 3 per cent. hydrochloric acid for two minutes 12 inches below the surface and rinsed with water.
7. Washed in 3 per cent. hydrochloric acid, plus 1 per cent. Lissapol A, for two minutes 12 inches below the surface and rinsed with water.

The lime water was made up with 10 pounds of hydrated lime per 100 galls. of water. Lissapol A is a detergent which it was thought might reduce the time of immersion necessary to bring the arsenical residue below the limit.

Fruit used in treatments 2 to 5 was washed in flat bushel cases to give control of depth of immersion

DEPARTMENT OF AGRICULTURE, VICTORIA

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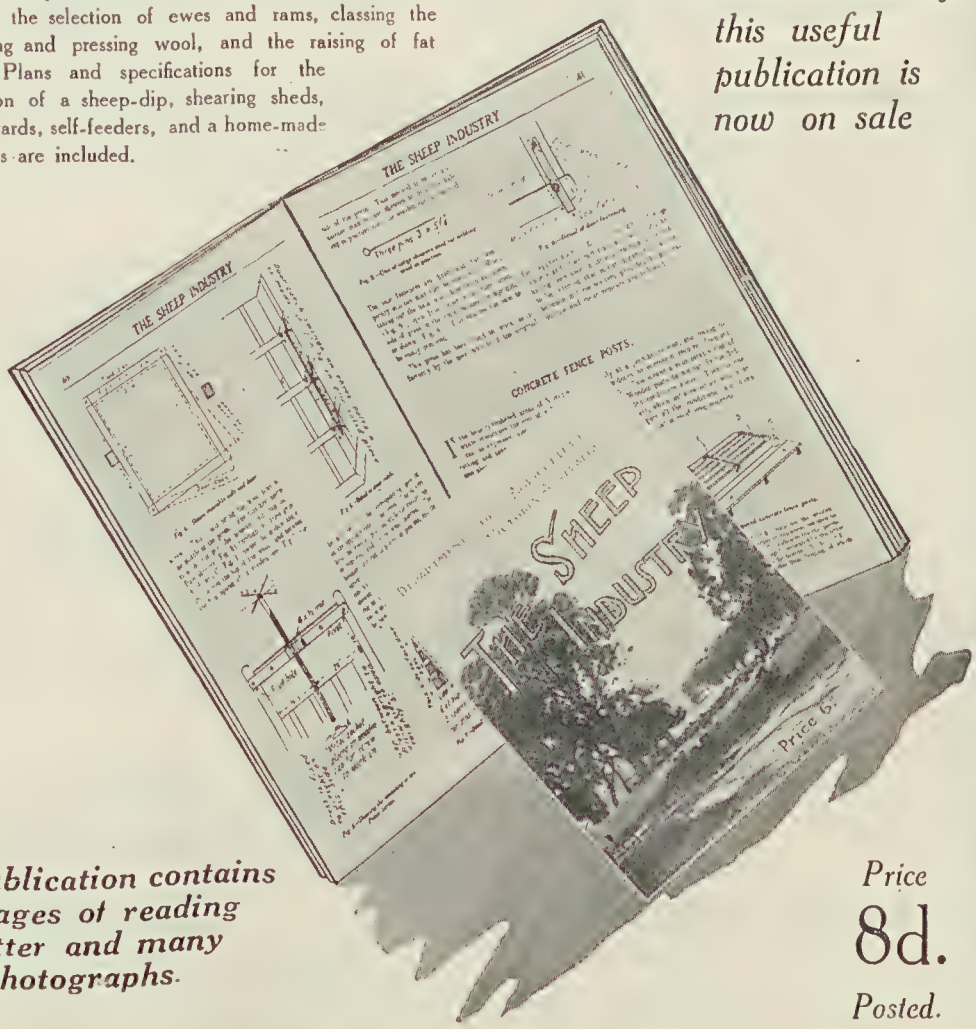

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WHEN SENDING PRESENTS to friends in BRITAIN at CHRISTMAS, or EASTER, on BIRTHDAYS, or at any time throughout the year, have you thought of VICTORIAN PRODUCE such as FRUIT, WINE, LAMB, JAM, or BUTTER as an acceptable gift ?

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GIFTS of the best Victorian produce can be sent at any time through the Department of Agriculture and arrangements made for delivery to the address given without any further expense than the amounts stated below, which cover cost, freight, and delivery charges.

DURING 1935 the number of gifts ordered was 2,778.

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	s.	d.
10 lb. of Choice Butter	15	0
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ORDERS to forward any of these to any address should be accompanied by remittances and addressed to the DIRECTOR OF AGRICULTURE, Treasury Gardens, MELBOURNE, C.2.

ORDERS for gifts to residents of the Irish Free State and European Countries are not at present being accepted.

Closing Date for Delivery by Christmas

24th October, 1936

The following MIXED Parcels are also available :—

1-lb. Carton of Butter	1 Tin of Apricots
1-lb. ,, Sultanas	1 ,, Peaches
1-lb. ,, Raisins	1 ,, Pears
1-lb. ,, Currants	3 Tins of Jam

for **12s. 6d.**

or the above assortment with the addition of—

3 Pint Bottles of Wine .. for **18s. 6d.**

TABLE VI.—ARSENIC TRIOXIDE IN GRAINS PER POUND ON FIVE CROWN APPLES—1935 TESTS.

	Treatment.	Arsenic Trioxide (As_2O_3). Grams per lb.
Unwashed		0·090
Washed in three per cent. hydrochloric acid.	For four minutes submerged no deeper than 6 inches, rinsed in water	0·0079
	For four minutes 12 inches below surface, rinsed in water	0·0086
	For four minutes no deeper than 6 inches, rinsed in lime water and douched with fresh water	0·0067
	For four minutes 12 inches below surface, rinsed in lime water and douched with fresh water	0·0062
	For two minutes 12 inches below surface, rinsed in water	0·0059
	Plus Lissapol A for two minutes 12 inches below surface, rinsed with water	0·0054

while that used in treatments 6 and 7 was washed in dump cases. The acid temperature was brought to 61° F. by the addition of hot water; the temperature of the rinse baths was 50° F. After treatment the fruit was sampled for arsenic analysis, and then cool stored for observation.

The results obtained are shown in Table VI., which shows that all treatments were effective in reducing the arsenic below the tolerance. The lower figures for treatments 6 and 7 were probably due to the greater agitation which the dump cases received compared to the flat bushel cases, which were necessarily held fairly steadily to maintain the correct depth. The use of Lissapol A did not improve the efficiency of the acid.

As in the first set of trials, core rot developed in the washed fruit, but in this instance was largely due to *Botrytis* sp. The Botrytis rot was dry and firm in contrast to the gelatinous rot caused by *Penicillium expansum*.

The percentage of core rot which developed in unwashed and washed Five Crown apples during seventeen weeks storage at 34° F. is set out in Table VII.

It is evident from Table VII. that the primary factor determining the amount of core rot was depth of immersion. Fruit submerged not deeper than 6 inches developed 9.2 per cent. of core rot, while fruit submerged to 12 inches developed 32.3 per cent. The rinsing in lime water of fruit not submerged more than 6 inches reduced the

TABLE VII.—PERCENTAGE OF CORE ROT DEVELOPED IN UNWASHED AND WASHED FIVE CROWNS DURING SEVENTEEN WEEKS STORAGE AT 34° F.—1935 TESTS.

	Treatment.	Penicillium Core Rot.	Botrytis Core Rot.	Total Core Rot.
Unwashed		% 0·0	% 0·0	% 0·0
Washed in three per cent. hydrochloric acid.	For four minutes submerged no deeper than 6 inches, rinsed in water	1·2	8·0	9·2
	For four minutes 12 inches below surface, rinsed in water	9·5	22·8	32·3
	For four minutes no deeper than 6 inches, rinsed in lime water and douched with fresh water	..	1·4	1·4
	For four minutes 12 inches below surface, rinsed in lime water and douched with fresh water	6·1	22·2	28·3
	For two minutes 12 inches below surface, rinsed in water	4·8	22·3	27·2
	Plus Lissapol A for two minutes 12 inches below surface, rinsed with water	3·1	12·4	15·5

amount of core rot to 1.4 per cent., but similar treatment of fruit submerged to 1 foot reduced the amount to 28.3 per cent. only. The use of 3 per cent. acid for two minutes instead of four did not markedly reduce the amount of core rot. The addition of 1 per cent. of Lissapol A reduced core rot by 12 per ent., but the amount was still too high for economic washing. The conclusion may be drawn from these figures that the safest way to wash apples of the open calyx tube type in acid is to keep them within 6 inches of the surface of the acid, and to rinse them immediately afterwards in lime water, followed if possible by a fresh water douche. It is also desirable to keep the strength of the acid as low as possible, providing it will remove satisfactorily the residue on the fruit (see Table IV.). Deep submersion and a strong acid bath are the two main factors in the initiation of core rot.

Summary.

Tests carried out during 1934 showed that—

(1) hydrochloric acid was the most efficient cleansing agent under hand washing conditions; and

(2) washed fruit kept in cool store quite as well as unwashed fruit.

Further tests during 1935 showed that—

(1) for normal residues immersion of fruit in 3 per cent. acid for two minutes was effective in removing the arsenic;

(2) the variety of fruit and the spray programme to which it had been subjected both influenced the treatment required; and

(3) excessive core rot was caused in certain varieties of apple by deep submersion, and core rot could be prevented by shallow washing and rinsing in lime water.

General recommendations concerning the washing of fruit for the removal of arsenical residue were published recently (2).

References.

(1) Strickland, A. G.—"Removal of Arsenical Spray Residue from Apples." Vic. J. of Ag., Dec. 1931.

(2) Cole, C. E.—"Arsenical Spray Residue on Fruit." Vic. J. of Ag., Jan. 1936.

Maize Trials (*Continued from page 533*).

adjacent to a check plot. The productivity of any variety is then determined by its yield in relation to the check plot rather than by its absolute yield alone. For example, last year the highest yield from any check plot was 93 bushels per acre, whereas the lowest was 61.8 bushels per acre. Obviously there is a big variation in soil fertility between these plots, hence the yield in relation to the adjoining check is regarded as the fairest way of expressing results.

All check plots were sown with Kruge Corn, which has proved a good yielder at Orbost. It is alleged to have been developed from a few cobs brought from Queensland some years ago by John Lynn. Prior to that it is understood it came from America with a good reputation as a corn yielder.

From an examination of the accompanying table of yields, it will be seen that first place was filled by Reynolds Bros.' Gold-mine, with H. McLeods' Silvermine second, Irvine and Richardson's Cornplanter third, Keith Lynn's Hickory King fourth, and James Nixon's Manning River White fifth. Yellow maizes filled first, sixth, seventh, and ninth places, the first and ninth places being filled by strains of Gold-mine, and sixth and seventh places by a strain of Funk's Yellow Dent, both samples being supplied by Mr. J. W. Lynn. It speaks well for the uniformity of this strain that the two samples should have filled consecutive places in the list.

Under the conditions holding last year, however, white maizes must be given pride of place for general performance, and until a little more is learned as to the manner in which the ear stalk and root rot disease will behave under normal summer conditions, it probably will be in the best interests of Orbost growers to increase the proportion of white maize in their bulk plantings.

It is quite possible that under normally dry summer conditions, the disease, though present in the district, may not assume the epidemic proportions in which it was present last year.

The Analysis of Soils

Directions for taking Samples

By W. R. Jewell, M.Sc., Agricultural Research Chemist

CHEMICAL analyses of samples of Victorian soils are undertaken for farmers by the Agricultural Chemist, for which a fee of 10s. 6d. per sample is charged. Where advice can be based on relatively simple quantitative tests, together with a qualitative examination of the soil, the fee is 4s. per sample. Simple individual determinations (as for salt content or reaction) are conducted for a fee of 2s. per sample.

To obtain a sample which is representative and suitable for analysis, the following directions should be observed :—

(1) With a spade, make a small clean hole reaching to the full depth of the surface soil.

(2) Take out a perpendicular slice of soil from the surface to subsoil and place in a clean bag or box.

(3) To obtain a fair average sample, repeat these operations at six spots at least, distributed over the area being sampled, the soil from each sampling being placed in the bag or box.

(4) The soil so taken should then, without delay, be turned out on a clean board or flagstone and thoroughly mixed. Place about two pounds of the well mixed sample in a clean container, on which identification marks are made, including the depth to which the soil has been sampled. Stones, except large ones, should not be removed from the sample.

(5) When sampling, as described above, the sample should be taken from the surface to the line of change between soil and subsoil. Where the top soil is very shallow or where there is no definite change to subsoil, a depth of eight inches may be adopted. In cases of doubt with shallow soils, &c., it is preferable to take samples of each different layer or stratum of soil and leave it to the agricultural chemist to mix them.

(6) If it is desired to submit a sample of the subsoil, a similar procedure is adopted, the subsoil sample to be taken from each hole after the top soil sample has been removed.

(7) If the soil in different parts of the area is manifestly of different qualities, samples of each kind should be forwarded.

In forwarding samples the following information must be supplied :—

(1) The depth of the samples taken ; (2) where the land is situated ; (3) whether the soil is from level country, swamp, alluvial land, or from hill country—if from hill country the aspect should be stated ; (4) if it is virgin soil, whether it is forest or open country—if forest, the kind of trees and undergrowth should be mentioned ; if open country, the kind of grasses growing on it ; (5) if it is in cultivation, how long it has been cultivated, what was the last crop, when and what was its last manuring, what has been the manuring and the rotation of crops in previous years, what has been the yield per acre, and what is considered a good yield in the district ; (6) whether the land is drained or not ; (7) what is the nature of the climate and seasons of the district, and what kind of weather prevailed for the few days previous to taking the sample ; and (8) what lies below the subsoil.

In addition it is necessary to state what special information it is desired that the analysis should furnish.

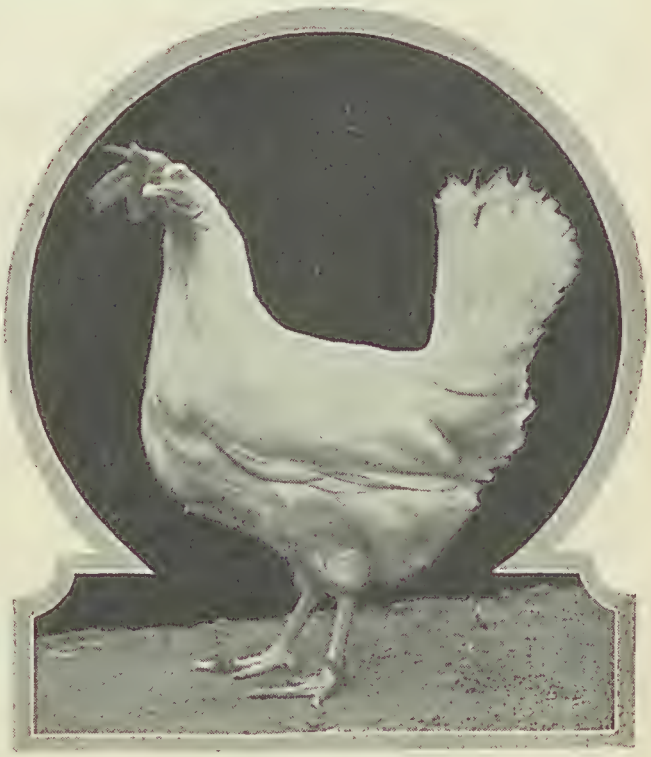
The samples, when obtained in the manner indicated, should be forwarded to Agricultural Chemist, State Laboratories, Gisborne-street, Melbourne, C.2, with carriage prepaid, the name and address of the sender being written on the parcel.

Burnley Egg-Laying Competition

Results of Winter Test

By

H. F. Clinton, Assistant Poultry Expert.



THE winter test, conducted in connexion with the Burnley Egg-Laying Competition, covers only the first four months (122 days) of the competition which commenced on the 1st April. In spite of the wet conditions during this four months' period, the egg production was quite satisfactory, and, in fact, was an improvement on the corresponding period of the previous year

The highest score in the test for teams of six birds (light breeds) was made by Mr. J. A. Stewart's team of White Leghorns. During the period of the test these birds laid 459 first-grade eggs. The dry mash section for White Leghorns was won by the Sorrento Poultry Farm's team, which laid 405 eggs. In the heavy breeds section the first prize was awarded to a team of Australorps owned by the "Belvedere" Poultry Farm. In the 122 days of the test these birds laid 557 first-grade eggs, the greatest number in the teams' test and 83 more than the best score during the 1935 test.

Certificates for the highest scores made by individual birds in the teams' test (light breeds) were won by Mr. J. H. Wernli's White Leghorn, first, with 95 first-grade eggs, while White Leghorns owned by Mr. P. C. Thomson and Mrs. M. G. Occleshaw tied for second place with a score of 92. In the heavy breed's section, Mr. F. W. Greenfield's Australorp gained first prize with 110 eggs, the highest score for any individual bird in this year's test. An Australorp, owned by "The Red Line" (Mr. G. R. Greenlees), was second with 105 eggs.

In the section for single birds, the best score (106 eggs) was made by an Australorp owned by Mr. H. R. Cropley, while Messrs. R. R. Christie and Son's Australorp was a very close second with 105 eggs.

First prize in the wet mash section (light breeds) went to Mr. T. L. Eastaugh, with Mr. J. Chatts a close second. The dry mash section was won by Mr. G. E. Thomas.

A summary of the leading scores is appended :

SECTION A.—TEAMS OF SIX BIRDS, TRAP NESTED.

Competitor.	Total First-Grade Eggs.	Competitor.	Total First-Grade Eggs.
Class 1.—White Leghorns—Wet Mash.			
J. A. Stewart ..	459	W. Vercoe ..	452
Class 2.—White Leghorns—Dry Mash.			
Sorrento Poultry Farm ..	405	"Ruburina" (V. D. Wallington) ..	374
Class 3.—Light Breeds other than White Leghorns—Wet Mash.			
Sorrento Poultry Farm ..	253	D. Granter ..	157

Section A.—*continued.*

Competitor.	Total First-Grade Eggs.	Competitor.	Total First-Grade Eggs.
Individual Birds—Light Breeds.			
J. H. Wernli ..	95	P. C. Thomson ..	93
		M. G. Occleshaw	93
Class 4.—Australorps—Wet Mash.			
"Belvedere" Poultry Farm (E. W. Lacy) ..	557	T. L. Eastaugh ..	489
Class 5.—Rhode Islands—Wet Mash.			
W. Donovan ..	400	W. Tedstone ..	364
Class 6.—All Heavy Breeds other than Australorps and Rhode Islands—Wet Mash.			
"Australpar" (H. Shaw)	373		
Individual Birds—Heavy Breeds.			
F. W. Greenfield	110	"The Red Line" (G. R. Greenlees) ..	105

SECTION B.—INDIVIDUAL BIRDS, SINGLE TEST.

Competitor.	Total First-Grade Eggs.	Competitor.	Total First-Grade Eggs.
Class 1.—White Leghorns—Wet Mash.			
T. L. Eastaugh ..	101	J. Chatts ..	99
Mrs. G. M. Jones	95	C. and D. McLauchlan ..	95
Class 2.—White Leghorns—Dry Mash.			
G. E. Thomas ..	97	H. I. Jolly ..	94

Section B.—*continued.*

Competitor.	Total First-Grade Eggs.	Competitor.	Total First-Grade Eggs.
Class 3.—Light Breeds other than White Leghorns—Wet Mash.			
W. Coutts ..	77	F. Boyle ..	75
Class 4.—Australorps—Wet Mash.			
H. R. Cropley ..	106	R. R. Christie and Son ..	105
Class 5.—Rhode Islands—Wet Mash.			
G. D. Lockhart ..	100	J. Young ..	94
Class 6.—Heavy Breeds other than Australorps and Rhode Islands—Wet Mash.			
"Australpar" (H. Shaw) ..	90	C. J. Coulson ..	83

Ducks.

The highest individual score in the competition for ducks was put up by Mr. H. H. Lloyd's Khaki Campbell, which laid 121 first-grade eggs, having missed laying on one day only, during the test. Second prize went to a Buff Orpington duck, owned by Messrs. C. and D. McLauchlan, which laid 120 eggs. Another bird owned by Mr. Lloyd was a close third with 119 eggs.

The leading scores are summarized below:—

Competitor.	Total First-Grade Eggs.
H. H. Lloyd (Khaki Campbell) ..	121
C. and D. McLauchlan (Buff Orpington)	120
H. H. Lloyd (Khaki Campbell) ..	119

Book Review

***A Text Book of Meat Inspection*—by J. Drabble, B.V.Sc.,**

Veterinary Officer in Charge of Inspection, New South Wales State Abattoir; Lecturer, Demonstrator, and Co-examiner in Meat Inspection, The Veterinary School, University of Sydney; Lecturer on Meat Inspection, Sydney Technical College.

This book deals in a comprehensive manner with all aspects of meat inspection met with under Australian conditions, and will be welcomed by Veterinarians, Medical Officers, Meat Inspectors, and Health Inspectors, and by those who are training for these positions in life. In addition Stock Inspectors and Dairy Inspectors will find in it much practical information which should be of the greatest value to them.

The book is divided into two parts, the first discusses elementary anatomy and physiology, and the second the general principles of meat inspection.

Of particular interest to Stock Inspectors and Meat Inspectors is the section dealing with ante-mortem inspection, slaughtering, and dressing.

The book is splendidly illustrated with reproductions from photographs taken by the author. Its price is £1 1s. 8d. (posted).

The publishers are Messrs. Angus and Robertson of Sydney.

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Flower Garden.

SOWING of seeds of summer and autumn flowering annuals is now urgent. The seed should be placed in a sunny bed made up largely of a thin loamy sand, with some loam or leafmould beneath the first three or four inches.

At the time of sowing, the soil should be loosened, and the seed just covered on the rough surface. Afterwards sprinkle the bed well with crumbled old leaves, or well broken up old manure.

A lookout must be kept for rose aphis, which should be sprayed with nicotine sulphate as soon as it is noticed. A second spray may be necessary later on. For mildew in roses, dust the bushes and the soil well with sulphur.

Dieback of roses is caused by obscure trouble and at present no remedy can be suggested. An unfailing sign is the dropping of the young leaves. The affected shoots should be cut out and burnt. If it persists, the best thing to do is to dry the plant out and burn it.

Prune all flowering shrubs as soon as they have flowered, and water well all shrubs about to flower.

The Orchard.

During the current month, spraying for Codling moth will be urgent. For apples, the first spray should be given when 85 per cent. of the petals have fallen; the spray should be made from lead arsenate paste (5 lb.) in 80 gallons of water. The second spray must be given 10 or 12 days later; and the third 14 days after the second.

For pears, the first lead spray is given about three weeks after the petals have fallen, but before the pears bend over. The second and third sprays follow at intervals of from 12 to 14 days.

Growers may, for further protection against Black Spot, include 6 oz. of bluestone, plus 6 oz. of freshly slaked lime in 80 gallons of water in the 2nd and 3rd lead sprays, and in subsequent white oil sprays. (The bluestone and lime should be added to about half the quantity of water in the vat, and the oil emulsion agitated in last, and the remainder of the water then added).

Oleanders.

A lime casein spreader may be used at the rate of ½ to 1 lb. in 80 gallons of the lead spray. In the first oil spray, a ¼-lb. spreader may be used, and ½-lb. in subsequent oil sprays.

If possible, apply the lime sulphur and lead sprays separately. If this is not possible, add the lead to the diluted lime sulphur and spreader, *immediately* before spraying.

Spray injury may result if oil sprays are applied within three weeks of a lime sulphur spray.

If freshly slaked lime, or "Limil" is used for making Bordeaux Mixture, the 6 : 4 : 40 formula becomes 6 : 6 : 40, and the 3 : 3 : 50 becomes 3 : 4 : 50. Care should be taken when employing slaked lime, because it is quickly converted to the carbonate form if left exposed to the air.

The Vegetable Garden.

If asparagus and rhubarb beds be well watered now, they will be far more productive, and will produce stronger and larger stems. An occasional sprinkling of blood manure may be given.

Seeds of all kinds of salading may be sown in rows, and in a bed. The soil should be well worked before sowing. A well worked friable bed, helps in the quick development of the crop.

Use ample sprinklings of calcium arsenate and bran to check the depredations of snails and slugs, which are bound to be abundant after the present moist season. Special beds or plots of seedlings may be dusted over with tobacco dust which will protect them for a few days.

Preparation should be made for planting out tomatoes by heavily manuring the beds in which they are to be placed. Similar work should be done in the preparation of beds for melons, pumpkins, marrows, and cucumbers. An early sowing of French beans may be made.

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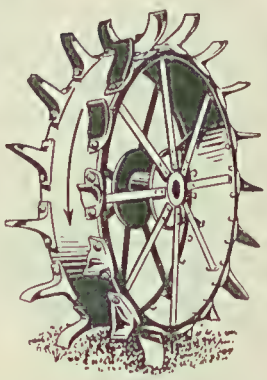

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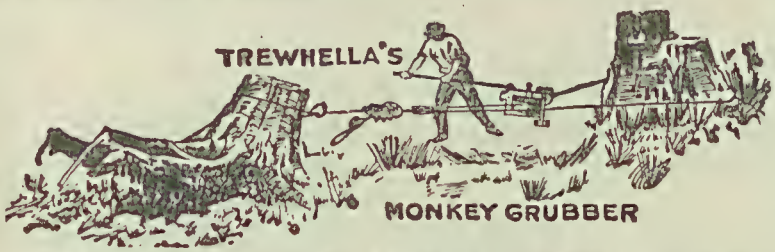

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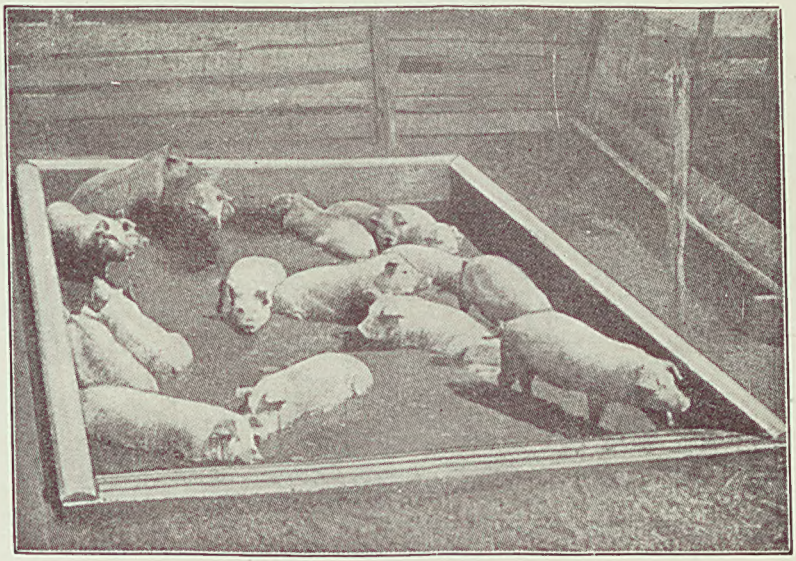

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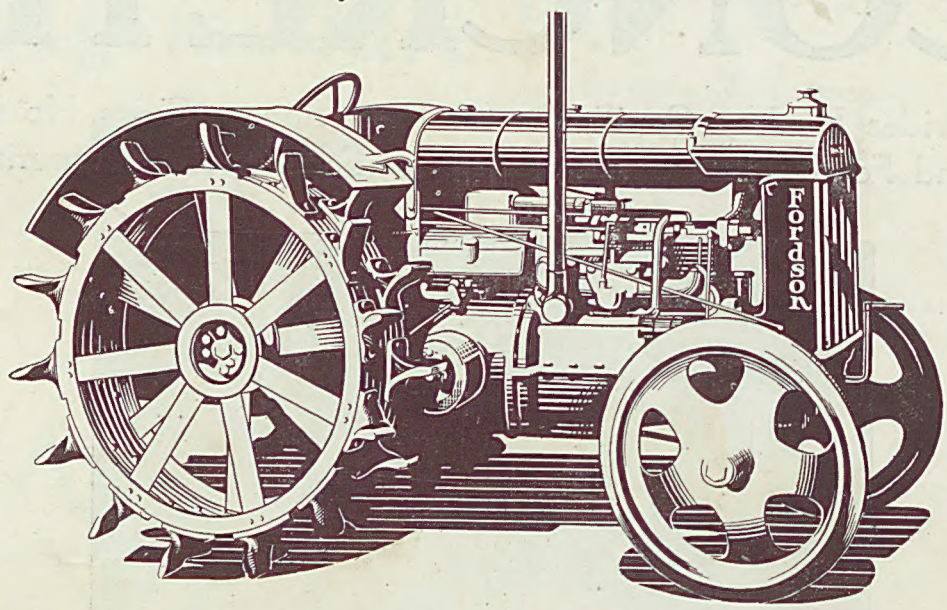

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